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The Farmer's Digest

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The Farmer's Digest

Volume 10 July, 1946 Number 3

2, 4-D, New Killer for Weeds

Condensed from Successful Farming

L. W. Kephart

United States Department of Agriculture

In AUGUST, 1944, there appeared in a technical magazine which is read chiefly by scientists, an article describing the strange effect upon bindweed of spraying it with one of the so-called "hormone" chemicals, 2,4-dichlorophenoxyacetic acid. According to the report, this weed, a very tough customer indeed, curled up and died when sprayed with a very dilute solution of this obscure growth-regulating substance.

The plant, it appeared, at first showed no ill effect, but within a few days the leaves twisted inward, the petioles curled, and the stems went through acute convulsions which, had the plant been an animal, might well have been described as mortal agony. Eventually the leaves fell off and the plant appeared to die.

This was the first public announcement of a new process of weed control which was destined within the next eighteen months to receive a whirlwind of publicity rivaling that of the famous insect-killer, DDT.

Unfortunately, the publicity was soon far ahead of the facts. Few of the state agricultural experiment stations had ever heard of the process. The Department of Agriculture at Beltsville, Maryland, had been testing the method for some time, but for various reasons was not, at that time, in a position to disclose it. The publicaton of the bindweed article opened the gates. Manufacturers who could obtain 2,4-D (as soon as it came to be known) immediately began to put weed-killers on the market. A flood of inquiries engulfed the official information agencies.

The claims that accompanied the early weed-killers were sometimes fantastic. Practically all of them claimed that a single treatment with the magic formula would destroy to the farthest root tip such injurious pests as bindweed, Canada thistle, Johnson

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grass, and poison ivy. To some it appeared that the arduous job of cultivating corn would soon be a thing of the past. Householders, they declared, would now enjoy weedless lawns. Highway commissioners would no longer have to mow the ragweed and burdock along the roadsides. Railroad section hands would have every Thursday off, because there would be no more weeds to kill. Utopia, so it seeemed, was just around the corner.

Harassed by lack of help, farmers bought the new 2,4-D weed-killers with enthusiasm. At first the results appeared to be all that the makers claimed. Bindweed vines turned brown and died to the ground. Dandelions in treated lawns went through yellowish contortions and ceased to exist. Some cornfields were completely cleared of cockleburs and velvet leaf by a once over treatment with a potato sprayer—and with no injury to the corn. Honeysuckle, which long had defied Eastern orchardists, began to disappear from around the trees. Canada thistle seemed on the verge of defeat in the oat fields. To many it appeared that the age-old struggle with weeds was at last approaching an end.

Toward the end of last summer, the first in which the new process had been thoroughly tried in the field, doubts began to arise. Careful farmers, digging into the soil where bindweed had been sprayed, found white, live roots. The vertical roots frequently were dead but the horizontal runners, or laterals, from which many of the sprouting stems arise, seemed full of life. Some had already begun to send shoots to the surface. A few men had time to spray a second time before frost ended the season. But for the most part the fields of bindweed, Canada thistle, whitetop, and other spreading perennial weeds that were sprayed in 1945 are still very much in the question-mark stage. Nobody knows whether the plants are alive or dead.

Meanwhile, some of the corn which had been sprayed in June, apparently without injury, began to show queer malformations. The growing tip ceased to grow, altho the plants were otherwise normal. In some fields the corn did not make brace roots, and the tall stalks fell flat when a strong wind came along. Some corn failed to tassle, or the ears did not fill. Yet, in many cases, the crop showed no damage and produced a normal or better yield. Obviously there was still something to be learned about spraying corn with 2,4-D. The same was true with wheat and other cereals.

At Saint Paul, Minnesota, in November, the North Central States Weed Control Conference held a day-long session on 2, 4-D. Reports of tests with 2,4-D from

all over the United States were carefully studied and reviewed. In the end the conference came, in effect, to these conclusions: (1) the use of 2,4-D to control dandelion and many other weeds in lawns is recommended; (2) the use to control some kinds of pasture weeds appeared justified, provided no proof is found of injury to animals and animal products; (3) the use to control weeds in corn and cereal crops should await further information as to the effect on crops; and (4) the final effect of 2,4-D on bindweed and other creeping perennial weeds is still unknown.

Thus, as matters stand, 2,4-D *is definitely* a good thing on lawns, is *probably* a good thing to use on pastures, is still *questionable* on corn and small grains, and is at least *promising*, possibly in combination with tillage and cropping on a considerable number of the bad perennial weeds.

A number of other facts or near-facts are becoming clear. The chemical is relatively cheap. Last year, in a seller's market, its price was sometimes exorbiant. This year there will be many brands of 2,4-D weed-killer on the market and the price will be competitive. The fact that a patent was recently granted on the use of 2,4-D for killing weeds will probably not affect the price materially. Generally speaking, it should be possible to spray an acre with 2,4-D in 1946 for $4 to $6. Some brands will cost more than that but the cheapest forms of 2,4-D, which are the sodium and ammonium salts, are being quoted for about $2.25 a pound. For most kinds of weed spraying, 2 to 3 pounds of chemical per acre are sufficient.

The large number of brands is due, in part, to the fact that the basic chemical, 2,4-dichlorophenoxyacetic acid, is not soluable in water, but must be combined with other chemicals before it can be sprayed. Aside from the two salts mentioned, this can be done by using carbonate mixtures, alcohol (methyl) esters, oil emulsions, and solutions in triethanolamine and other substances. In addition many manufacturers include a wetting agent, altho the value is doubtful.

Thus far, no outstanding or consistent advantage has been shown for any of the 2,4-D preparations over others. In general, the results with the different kinds have been similar. So far as there is any present knowledge, the choice of a 2,4-D weed-killer may well be based on price-per-acre to apply.

There is a widely held misbelief that 2,4-D is harmless to the soil. It is true that 2,4-D is not nearly as harmful as sodium chlorate, sodium arsenite, and borax. Nevertheless, some injury does occur and should be taken

into account before the chemical is used. Soil which has been treated with 2,4-D, either directly or when applied to weeds, is likely to show more or less impairment of seed germination for as long as three months afterward. Many crops, including most vegetables, produce very poor stands if planted within three weeks of a 2,4-D treatment. Others including most grasses, are less seriously affected. Until the details of the phenomenon are known, it would be wise to avoid planting any crop immediately after 2,4-D application.

No evidence has been produced yet that 2,4-D is harmful to animals, at least in the quantity present on treated forage. Cows, sheep, horses and hogs have been grazed on treated pastures with no ill effect. Two or three persons who have worked with the chemical report a slight irritation of the skin after long exposure, but nothing more. Until the facts have been fully determined, however, it would be unwise to overlook the possibility.

A noted characteristic of 2,4-D which may be either an advantage or a disadvantage is that it does not affect grasses. That is why lawns, cornfields, and grainfields can be cleared of weeds without much injury to the grass. On the other hand, it means that 2,4-D is of no value in fighting quackgrass, Johnson grass, pigeon grass, and the like. At the same time it means that fields which have been sprayed to kill broadleaved weeds are likely to come up in dense stands of weedy grasses after the weeds have died.

Practically all vegetables, most flowers and many ornamental shrubs are highly sensitive to 2,4-D. Consequently this method of weed control is of little utility in gardens. Even in lawn-weed control, care must be taken that the chemical does not drift onto valuable plants—a matter not always easy to arrange.

The peculiar effect of 2,4-D on plants has given rise to some incorrect explanations of its action. It is commonly said that the plants die of "overstimulation" or that they "grow themselves to death." The exact opposite is the case. The plants die of starvation caused by the disappearance of starch in their tissues. The odd twisting and bending is due merely to unequal cell division or enlargement on one side of the stem.

The standard strength of a 2,4-D weed-killing solution is 1,000 parts of the basic chemical to 1,000,000 parts of water or a 1/10th-of-1-percent solution. A few weeds are killed by a weaker solution than that and several need a stronger. Because most persons are not in a position to figure parts per million or percentage solutions, especially of commercial brands, manufac-

turers usually indicate on the package the dilution that should be used for different kinds of weeds. As a rule, these directions are quite accurate.

In the lists below are given the strengths and the numbers of applications necessary to kill the representative weeds listed under them. The lists are far from complete, and are subject to change, but they will serve as a guide until more information is available.

Weak solution (1,000 p.p.m.) One treatment

(Note — p.p.m. means parts 2, 4-D per million parts water.)

Beggar-ticks
Bitterweed
Black Medic
Blue bur
Buttercup
Chickweed
Cinquefoil
Dandelion
Dead nettle
Dichondra
Dog fennel
Evening primrose
False flax
Fanweed
Giant ragweed
Ground ivy
Kochia (young)
Lippia
Marsh elder
Morning-glory (annual)
Mouse-ear chickweed
Narrow-leaved plantain or Buckhorn
Peppergrass (young)
Pigweed (young)
Puncture vine
Ragweed (young)
Russian thistle (young)
Shepherd's purse (young)
Skeletonweed
Speedwell (most species)
Sunflower
Sweet clover (young)
Velvetleaf
Water hyacinth
Wild mustard (all species)
Winter cress
Wormwood

Weak solution (1,000 p.p.m.) Two or more treatments

Bindweed
Canada thistle
Hedge bindweed
Klamath weed
Lupine
Locust
Sagebrush
Sumac
Texas blueweed
Virginia creeper

Medium solution (1,500 p.p.m.) One treatment

Broad-leaved plantain
Burdock
Carpetweed
Canada fleabane
Cocklebur
Coffeeweed
False dandelion
Goatsbeard
Gumweed
Lamb's-quarters (and other goosefoots)
Purslane
Spotted spurge
Teasel
Western ragweed
Wild carrot

Medium solution (1,500 p.p.m.) Two or more treatments

Gaura
Honeysuckle
Leafy spurge
Perennial sow thistle
Scouring rush
Stinging nettle
Tansy
Water hemlock
Whitetop
Wild garlic

Strong solution (2,000 p.p.m.) One or more treatments

Blue lettuce
Buffalo bur
Bur ragweed
Cattail (young)
Cockle (all species)
Dock (all species)
Horse nettle
Knotweed
Night-flowering catchfly
Nightshade
Pokeweed
Prickly lettuce
Sheep sorrel
Smartweed (annual and perennial)
Star thistle (all species)
Trumpet vine
Tule
White horse nettle
Wild buckwheat
Wild gourd

2, 4-D not yet found reliable on:

Alkali mallow
Barnyard grass
Bermuda grass
Blackberry
Brome grasses
Cactus
Corn gromwell
Crabgrass
Fern (bracken)
Goldenrod
Goose grass
Ground cherry
Ironweed
Johnson grass
Juniper
Huckleberry
Maple
Mayweed
Milkweed
Mullein
Nut grass
Oak
Pigeon grass
Poison ivy
Poison oak
Poison sumac
Quackgrass
Russian knapweed
Sandbur
Toadflax
Violet
Wild aster
Wild barleys
Wild oats
Wild roses
Wood sorrel
Yarrow

Green Pastures in Hot Weather

Condensed from American Agriculturist

George Serviss

BROWN and dried up—that's the normal condition for most of the permanent or native pastures for a good part of the July-August-early September period. Green pasture can be provided, but some thought must be given to it before it is needed. We should not think of the usual summer short grass period as an emergency. It is no more of an emergency period than mid-winter. Things that occur at regular intervals are not emergencies and the summer short grass period should be planned for as regularly as the winter period.

Some dairymen provide for this period with corn silage, a few with grass silage and hay; others feed grain heavily, and more each year are providing good pasture. It probably does not make much difference to the cow what she gets as long as she is fully fed. But the average cow is not fully fed in the summer. Lack of feed is the main reason for the slump that occurs in most herds when feed gets short on the permanent pastures. Dairymen who regularly make provision for this slump are able to keep production up.

The cheapest feed by far that can be provided is pasture. Providing pasture also involves much less labor than relying on hay and silage. Although improved and regularly fertilized bluegrass pastures are much better than unimproved permanent pastures during this period, some other pasture than permanent bluegrass is usually necessary to do the job as it should be done.

The most dependable summer pasture crop is Sudan grass. It is a hot weather grower and is capable of producing eight to ten tons of green feed per acre. To do this it must be sown on a good piece of soil and be well fertilized. Ten tons of superphosphated manure per acre plus 200 pounds of a complete fertilizer in the drill will produce a good crop. Where manure is not available, 500 to 600 pounds per acre of 10-10-10 or 7-7-7 would be in order for those fortunate to have obtained such nitrogen grades. Since not many will be able to obtain these grades, as high a nitrogen grade as possible should be used. Two hundred pounds of 3-12-6 or 4-12-4 supplemented with 150 pounds of ammonium nitrate

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would be quite satisfactory. The germination of Sudan grass seed is often impaired by applying too much fertilizer in contact with it. Where more than 200 pounds per acre is used, it should be drilled separately from the seed.

Sudan grass seed also often carries fungous diseases that may attack the seed during germination, or the seedlings. This is especially true if the soil is cold and wet during the germination period. Seed treatment, therefore, seems advisable as an insurance measure. There are several satisfactory preparations for this, among which are New Improved Ceresan and Arasan. Directions for applying will be found on the containers. Sowing should usually be delayed until about a week after the average date for planting corn in a community.

There is considerable interest in the possibility of establishing hay and pasture seedings with Sudan. Some good seedings have been obtained where the Sudan was grazed, but failures have been the rule where it was allowed to reach the hay or silage stage. Additional observations are needed before definite recommendations can be made.

Aftermath from early cut Ladino clover-grass mixtures is another very practical solution to the summer pasture problem. For the aftermath growth to be dependable, haying must be early. It is seldoom that haying can be early on all of the hay acreage. The Ladino fields that are to be grazed should be cut first. Making grass silage of this early cut Ladino grass will insure saving the high feeding value. Early cutting also makes for easier sowing. Aftermath from hay fields is dependable only for as long as the legumes persist. For this reason, and many others, perennial legumes such as Ladino and alfalfa should be included in all seeding mixtures.

Oats are finding considerable favor as summer pasture, and certainly pasturing them utilizes their feeding value more fully than harvesting them for grain. They do not make the comeback after pasturing, though, that Sudan does and they do not last as late into the season. Being sown earlier than Sudan, they are ready for grazing earlier and fill in well the short gap that sometimes occurs between bluegrass and Ladino aftermath or bluegrass and Sudan. Dairymen who depend primarily on Ladino clover on plowable land are finding that by using oats as a nurse crop when they reseed, and pasturing them off, they sacrifice little or no pasture in the seeding year and have a better balance throughout the season.

One other possibility should be mentioned and that is the use of fertilizer nitrogen on permanent

pasture in the summer. June applications have not yet proved to be very dependable practice for providing July and August pasture. Somewhat later application of nitrogen will boost fall pasture-age considerably. Nitrogen for this purpose is probably best applied the last half of August. Considering the present cost and scarcity of feed grains, it certainly seems a desirable practice.

To get the best return from this nitrogen, it should be used in combination with phosphoric acid and potash or where these plant foods have recently been applied. It should be used too, where grass and not clover predominates in the pasture. Mixtures such as 10-10-10, 8-16-16, and 5-10-10 at rates from 400 to 700 pounds to the acre will greatly increase the fall grazing if rainfall is at all normal, and will result in marked improvement for the next two or three years. Where just nitrogen is needed, 150 pounds of ammonium nitrate is about right.

This spring, the fertilizer industry was unable to meet completely the demand for high nitrogen and high potash fertilizers. Present indications are that the supply of such mixtures and materials may not be any better in the spring of 1947. Dairymen who want to fertilize their pastures and haylands and can get the fertilizer to do so this summer and fall should get it and apply it. Applications to grass and legume sods in the summer and fall give entirely satisfactory results. Most dairymen are shorter of pasture in the fall than in the spring, which is another good reason for late summer and early fall application.

Scientific Research for Better Beef Production

Condensed from Coastal Cattleman

D. S. Burch

BEEF steaks from cattle that are bred and fed to please the taste rather than the eye are on tomorrow's program for better meat. Experiments are under way to produce more palatable meats through a scientific breeding and feeding program.

Plans and specifications, so to speak, for quantity output of this high-quality beef are already well advanced. In developing them, research scientists of the U. S. Department of Agriculture and their colleagues in the State colleges and the meat industry have dropped some old traditions and have added innovations.

It is common knowledge that most of the highly specialized beef breeds of cattle, such as the Shorthorn, Hereford, and Aberdeen Angus, have been centuries in the making. In Great Britain where they were developed, King Charles II was so delighted with the quality of a particular beef loin that he knighted the cut—now the familiar "sirloin." Some historians credit the same act to Henry VIII and James I. At any rate, into the development of choice beef cattle have gone the skill and artistry of famous breeders—men who conjured up an ideal animal and then by skillful selection worked to make it a reality. They displayed their creations at stock shows which promptly became, as they are to this day, colorful events.

But while grand champion steers and other prize winners generally yield high-quality beef, several sober facts have confronted breeders and stockmen in general. One is the considerable range in quality even among seemingly well-bred lots of animals. And besides the good ones there are generally some culls, comprising the tag end of the herd. Another problem is that of finish. A liberal amount of fat seems necessarily to come with tender, juicy, flavorful meat. Yet most consumers look upon much fat as wasteful. The problem in this case is to get better distribution of the fat, preferably in shining rivulets through the lean and less in thick layers.

Although he is not too familiar with the details of these and related production problems, the consumer has learned about them in a general way. He has also made some comparisons and is baffled. If an apple orchard or a strawberry bed, he ponders, can

Reprinted by permission from the Coastal Cattleman, Beaumont, Texas, April, 1943

produce fruit of uniformly fine texture and flavor, true to its variety, why shouldn't the same be true of a whole herd of cattle?

Prompted by much the same reasoning, trained livestock and meat specialists have done some serious thinking. In wartime, of course, when hunger stalks many lands, the quality of food is less important than quantity, quickly obtained. But looking ahead beyond the war to a time when quality will again loom large in the economics of meat production, the specialists have been taking stock of the manner in which science can serve producers and consumers alike. And these specialists have already come forward with illuminating findings.

In exploring new biological fields, investigators commonly pick out inexpensive small forms of life to use as "guinea pigs." That is just what the department scientists did in this case. And for guinea pigs they used guinea pigs—thousands of them, including inbred families, control stock, and crossbreeds. The geneticists collected data on weight, size, color, fecundity, abnormality, and other traits. Using methods of statistical analysis unknown to early cattle breeders, they worked out curves and charts to get a clear picture of how heredity works, and especially of the extent to which inbreeding can safely be used to purify germ plasm, so as to produce animals of uniformly high quality.

One finding highly significant in the light of later studies was "that rate of maturity can be altered by breeding" and that "fast-maturing animals are usually smaller than the slow-maturing ones." In addition, the studies showed the importance of "conditions of optimum nutrition and environment" in connection with breeding in any thoroughgoing test of productive efficiency. Only under such conditions, the scientists declared, can differences in rate of gain and maturity "be brought to light and fixed." These findings led to extensive record-of-performance studies that were essentially a search for living patterns—animals that would consistently produce high-quality offspring.

The four main specifications were: (1)Good weight for age, promising rapid growth; (2) desirable proportions—meaning in particular, good development of parts that produce the choicest cuts; (3) quality of meat, to bring consumer satisfaction; and (4) efficiency in the use of feed, essential from a business standpoint. Research showed that this combination of qualities in one animal was attainable.

Records of performance for beef cattle are by no means revolutionary. They follow much the

same trail as that blazed by dairy cattle and poultry. Long ago close observers found that even the most skilled judges could not identify the best milk cows—but records did. Poultry judges also missed badly in picking out the top-flight layers, but here again production records put the finger on them accurately. With these precedents plus the direct evidence that research has provided, the investigators are now confident that they are on the right road to more efficient cattle production.

The full picture of record-of performance procedures as applied to beef is still incomplete. It resembles a jigsaw puzzle with many parts neatly fitted together but with others yet to be supplied. In line with the need for good feeding and environment—so that high quality cattle can show their true worth—the scientists have determined that feeds produced in soil containing minerals essential to good grass, forage, and grain crops play a big role in yields of high-quality beef. They have extended their studies also into the fields of meat grading, storage, refrigeration, and finally into the culinary and gastronomic field—the final proving ground of food products.

Breeding, the scientists found, has a definite influence on the tenderness, palatability, and nutritive value of beef. For instance, a three-year test of two Hereford sires showed that the calves of one yielded appreciably more tender meat than those of the other. The studies also furnished evidence that the proportion and distribution of fat are influenced by genetic factors. In another comparison, samples of meat from steers of the same breed but differing in type varied as much as 12 percent in moisture content, 23 percent in fat, 14 percent in protein, and 7 percent in ash. Differences in juiciness of the meat were also observed. Results of other experimentation showed that a bull's first 5 to 10 calves are enough to establish his value as a sire.

It is not necessarily true that the meat of a young animal is tender and that of an old one tough, although tenderness generally decreases as an animal gets older. Likewise rapid growth, which commonly means greater economy in feed, increases the likelihood of tenderer meat. Steers have been found to yield more lean meat and bone than unbred heifers of comparable weight. Various feed combinations and levels of feeding, the research showed, affected the composition as well as the tenderness of the meat.

In the chemical field— and this pervades practically all branches of animal science—one current practice based on research is the

use of disodium phosphate in drinking water to make cattle breed better and grow faster. The phosphate is added to the drinking water to help make up for a phosphorus deficiency that exists in some areas in the soil and the resulting vegetation. In parts of Texas where the deficiency has been serious, the use of such a supplement has become popular with many ranchmen. Under some circumstances phosphorus is given in the feed, or a fertilizer rich in phosphorus is added to the soil, with results of both more and better beef.

The color factor in beef has received scientific study. White fat in beef has been generally preferred in the meat trade and by consumers. Yet yellow fat, found as often in fresh beef, is caused chiefly by the deposition of carotene from such feeds as legume hay and grass. Since carotene is the so-called precursor, or carrier, from which vitamin A is developed by the body, yellow fat in beef may indicate higher vitamin-A potency than white fat and thus be an advantage rather than a cause for discrimination. Still on the color subject, the investigators confirmed the trade observation that older cattle have darker meat than young cattle, but found that dark meat is not necessarily lower in palatability and tenderness.

The influence of feed on meat quality pops up repeatedly in various lines of experimentation. In a mechanical test of cooked meat 15 per cent more force was required to sheer through roasted rib samples from steers fed on grass alone than through similar samples from steers that had received, in addition to pasture, a grain feed of corn and cottonseed meal. Much can be said, however, for well-finished grass-fed beef, and the economy of its production.

This mechanical test was developed to eliminate, so far as possible, the element of human error in rating meat for tenderness. The instrument records the amount of pressure needed to cut through a sample of meat. But lest it be assumed that research is always cold and calcuating, with no room for crystal gazing, the scientists have sprung a surprise. Through a study of the size and number of ice crystals that form in the muscle tissue of frozen beef, they have found a way of freezing that makes the meat tenderer. For instance, beef frozen and stored at 20° F. was about 12 per cent more tender than beef chilled at 30°; and beef frozen at —10° or—40° was still more tender—about 18 percent more in both cases—than the chilled beef. A splitting by the ice crystals of the fibers in the meat is the scientists' explanation of the tenderizing effect of

very low temperatures. They found no such crystals within the fibers at temperatures only a few degrees below freezing. At 0° F. the crystals became clearly evident, and at still lower temperatures they were finer and more plentiful.

Freezing may also be used in combination with the familiar practice of aging, or ripening, beef at a temperature of 34° to 38° F., which checks bacterial action but enables the natural enzymes in the meat to develop and tenderize it. Porterhouse steak ripened for 35 days after slaughter of the animal proved to be 28 percent tenderer than that ripened only 5 days. The freezing of beef after aging tenderizes it further, but the effect of freezing decreases as the aging period increases.

Still other experiments have dealt with meat shrinkage during cooking, through evaporation or dripping losses. These can be accurately measured, by weight, and correlated with cooking time, oven temperatures and other factors. For flavor evaluation, chief reliance is on panels of expert meat judges, which commonly include both men and women.

Upsetting the old theory that meat must be seared if the juices are to be held, the investigators found that the moderate temperature throughout the cooking period, and cooking meat only until it is done as desired, are far more effective in keeping shrinkage to a minimum and yielding a tender, juicy, evenly cooked cut.

A broad view of progress to date indicates that most of the developments mentioned are already bearing commercial fruit, at least on a small scale. Necessarily, economic factors loom large in practical applications, especially those that involve production costs. Prices of cattle, feed, labor, and land—present and prospective—influence both the quality of beef and its output. The results of research on meat ripening, refrigeration and storage can probably be applied sooner. So can those on cookery.

Probably nowhere else in the world is there such a happy combination of helpful available information on stock raising and its end product — meat — as in the United States. So after the war when you order a juicy steak or relax over an informal hamburger, you may thank the research scientist as well as the chef if you find it more satisfying and better tasting than any you have eaten before.

Ketosis (Acetonemia) in Dairy Cattle

Condensed from Holstein-Friesian World

J. C. Shaw

University of Maryland

PROBABLY every reader of this article is familiar with the term "milk fever" and many of you know that it is caused by a sudden decrease in the blood calcium at calving time. Many of you are also familiar with another ailment of cows called ketosis or acetonemia. The term ketosis is a more nearly correct term than acetonemia and will be used throughout the remainder of this article. Ketosis is an ailment which is often mistaken for milk fever but it is often caused by a decrease in the amount of sugar in the blood rather than a decrease in blood calcium.

How can we tell whether a cow has milk fever or ketosis? The answer lies in a proper understanding of the symptoms, and the use of certain tests which can be applied to urine and blood. Milk fever ordinarily occurs within a few hours after calving and the cow usually becomes partially paralyzed and lies with her head back on her flank.

The cow suffering with ketosis, on the other hand, seldom exhibits symptoms until several days to several weeks following freshening. The symptoms vary somewhat but usually include a lack of appetite, depressed appearance, loss in weight, and a decrease in milk production. Incoordination or general stiffness may also be observed and may even precede the other symptoms. Sometimes the herdsman may not know that anything is wrong, until the cow is turned out some morning and is observed to stagger or weave slightly or walk with her head held in an abnormal position. In some cases the cow will be observed to stand with her nose pressed tightly against the manger. Less frequently cows with acetonemia exhibit a crazed appearance and have been observed to paw partitions, foam at the mouth and walk through barbed-wire fences. The author has even observed a cow with ketosis go completely blind for several days. The cow may lapse into a coma. A few fail to recover. These symptoms are believed to result primarily from the effect of a low blood sugar on

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the brain. The brain must obtain its energy from the burning of blood carbohydrate since it cannot burn fat or protein as can the other body tissues. Some of the symptoms are not unlike those which occur in humans suffering from a deficiency of blood sugar.

A rather sweetish odor may be detected on the breath of the cow with ketosis due to the exhalation of acetone and frequently a foreign flavor is imparted to the milk. There is considerable variation in the ability of people to detect this odor and flavor. On one farm in which the owner had had considerable experience with ketosis, the head of the family (the wife) was able to detect the flavor in the bulk of 8 cows in which only one had ketosis and before any symptoms of ketosis had been observed. Experienced judges of milk, on the other hand, could not detect the off flavor. The farmer's wife described the flavor as "feverish." In more severe cases in which the milk is not mixed with that of other cows, the sweetish flavor of acetone can be detected readily by most people.

Milk fever and ketosis, while apparently unrelated, have many things in common. Milk fever is brought on by the sudden and relatively large production of milk at calving time. Considerable calcium is removed from the blood in the formation of this milk. For some unknown reason, the body cannot replace this calcium fast enough to maintain a normal level of calcium in the blood and as a result the cow collapses. Under normal conditions, calcium which is stored chiefly in the bones, will pour into the blood stream and replenish the blood supply. Feeding additional calcium before calving will not prevent milk fever. Neither will calcium in the feed increase the blood calcium of the cow suffering from milk fever.

As most "old timers" know, milk fever can be cured by pumping air into the udder. This builds up sufficient pressure within the udder to retard milk secretion and slow up the passage of calcium into the milk. However, it has been found that the cow will recover more quickly and safely by injecting some form of soluble calcium, usually calcium gluconate, directly into the venous blood.

The picture is somewhat similar in the development of ketosis except that in this case blood sugar is involved instead of calcium. After freshening, the amount of blood sugar removed by the udder increases many fold for the production of milk. Ketosis develops when the body cannot replace the sugar as fast as it is removed from the blood. We have found that the decrease in

blood sugar is paralleled by and probably caused by a decrease in the amount of "animal starch" or glycogen which is stored principally in the liver. This "animal starch" acts as a reservoir to replace the sugar in the blood as it is used up and must be replaced within a short time after it has been converted to blood sugar. Under normal conditions, food starches are used by the body to replenish the "animal starch" in the liver. Ketosis develops when the liver is unable to replenish its supply of glycogen or "animal starch" as fast as it is converted into blood sugar. When this happens, the blood sugar decreases.

The liver attempts to compensate for the lack of glycogen by using fat. In the process certain substances, called acetone bodies or ketones, are formed which pass into the blood. The terms, acetonemia and ketosis, are derived from the presence of these acid-like substances in the blood and urine.

Acetonemia by definition means an excess of acetone bodies in the blood. Ketosis, meaning an excess of ketones in both blood and urine, is probably more nearly correct since large amounts of ketones are present in both the blood and urine of the cow suffering from this ailment. The term, ketosis, has been used to describe a similar condition in humans and in small animals for many years prior to the recognition of ketosis in ruminants.

Acetone bodies or ketones appear to serve a useful purpose especially in the earlier stages of ketosis as they provide energy to practically all of the body tissues with the exception of the brain. For example, we have found that practically all of the energy for the formation of milk, by the cow suffering with ketosis, is derived from the burning of these substances. Even in the normal cow, enough of these substances are formed in the body and used by the udder to supply approximately 40 per cent of the energy for milk formation. In later stages of ketosis, the blood ketones tend to produce an acidosis and are therefore harmful when the ailment continues for some time.

Ketosis is an ailment which occurs most frequently in high producing cows in late winter and early spring. Generally, these cows are in good condition at calving time and oftentimes are, in fact, very fat. After the cows have been turned out, to graze on pasture grass for a week or so, the number of cases occurring are usually much less than in late winter. In one area in which the author was cooperating with the local veterinarian, from two to five cases daily had been observed for several weeks. Most of the cows in that area were turned out to pasture within a

period of one week. The cases of ketosis decreased dramatically and only three or four were observed within the following six weeks. Whether this was due to some necessary nutrient which was being supplied by the grass or merely to an increased feed intake due to the palatability of the grass is not known. Ketosis has been observed in cows on good grass pasture, however, so that under certain conditions, at least, pasture grazing does not prevent the occurrence of this condition.

In order to obtain more information on ketosis, studies were conducted in herds where numerous cases had been reported. Blood samples were drawn from cows at frequent intervals for several weeks before freshening and for several weeks afterwards. A number of the cows developed ketosis while this work was in progress. As a result, we succeeded in obtaining, for the first time, the blood sugar and ketone picture during the actual development of ketosis under farm conditions. The blood sugar did not fall appreciably below the normal of 40 mg. per 100cc until after calving when it showed a gradual but definite decrease. At the same time the blood ketones increased. It was not until the ninth day after calving, when the blood sugar had fallen to a very low level, that the first symptoms were observed. This is undoubtedly typical of many cases occurring under farm conditions although some develop more rapidly and others develop over a longer period of time.

In one of the herds which was under observation, several cows developed a mild ketosis without exhibiting any symptoms. These cows lost weight rapidly and did not produce as well as was expected. Each year there are a relatively large number of cases of ketosis of sufficient severity to require the services of a veterinarian. It is quite probable that there are many more cases of lesser severity which go undetected. Many cows which are not just right after calving or which produce much less than is expected on the basis of their condition at calving and past performance may in reality have had ketosis of insufficient severity to be detected.

Early in the course of our work, we became aware of the fact that the amount of feed consumed by the cow was an important factor in the development of ketosis. Since the condition usually develops a short time after calving, this was the particular period which was selected for our studies.

In the experimental production of ketosis the feed intake was maintained considerably above requirements during the dry pe-

riod until 10 days before calving when it was cut to 60 per cent of requirements. Following calving the feed intake was cut still further and maintained at a level varying between 32 to 50 per cent of the actual requirements of the cow. In terms of pounds of feed, the cow received 6 pounds of hay and 2 pounds of grain for the 10 days preceding calving and 6 to 10 pounds of hay and seven pounds of grain until 14 days after calving. The blood sugar had decreased to a little less than half of normal by the fourteenth day after calving and the ketones had increased more than ten times the normal value. At this time, the feed intake was stepped up first to 80 and then to 100 per cent of requirements. The blood picture returned to normal within a few days. The cow became very lethargic and was eating listlessly at the height of the ketosis and would undoubtedly have shown more severe symptoms if the feed intake had not been increased. The same experiment was repeated on a number of cows with similar results.

A restricted feed intake before or after calving or both is probably only one of the factors which will produce or contribute to the production of ketosis in dairy cows. It may not even be the most important factor. We have observed cases of ketosis in the field which were apparently due to fasting and have been able to cure a few of these by an increase in feed consumption alone. Sometimes this was accomplished by altering the ration until something was found which the cow would eat. More frequently, however, the case had progressed to the point where other measures were required. Other cases have been observed where it was difficult to ascribe the ailment to a limited feed intake.

Some have claimed that the condition is due to a deficiency of vitamin A in the feed. However, in rather extensive experiments we have failed to find a single case of ketosis in which either the blood plasma carotene or vitamin A was low. In addition, we administered massive doses of vitamin A without any beneficial effect, giving as much as four million units of vitamin A per day. Claims have also been made that the ailment could be cured with thiamine (vitamin B1). In our studies, massive doses of this and other B vitamins were administered both intravenously and orally without any apparent beneficial effect. Likewise, methionine, an essential amino acid of aid in preventing ketosis in small animals, was not beneficial when administered intravenously and orally. A certain percentage of the cases of ketosis recovered spontaneously without treatment.

It is probable that many of the claims that certain substances are effective in the treatment of ketosis are due to such recoveries. Most of these claims appear to be made on the basis of either too few data or incorrect and incomplete diagnosis and possibly inadequate chemical techniques.

The best treatment to date is the injection of dextrose directly into the venous blood supplemented by the feeding of some form of soluble sugar such as molasses or corn sugar. Severe cases may require several injections. Ketosis is frequently mistaken for milk fever not only because the symptoms are somewhat similar but because calcium gluconate, which is used for the treatment of milk fever, contains sufficient glucose (dextrose) to produce a beneficial response in a cow suffering from acetonemia, especially if the case is not too severe. Ordinarily much more dextrose is needed for the efficient treatment of ketosis. When it is difficult to diagnose the case or when ketosis and milk fever are both believed to be involved, it is wise to inject calcium gluconate followed by a straight dextrose solution.

Ketosis is not always diagnosed correctly. It is important to make use of our knowledge of the signs and symptoms of ketosis as well as the urine qualitative test is making a diagnosis. The urine test by itself is not infallible because any abnormality which throws the cow off feed such as mastitis and metritis, or just plain indigestion, will produce an increased production of blood ketones which spill over into the urine and give a positive test. This type of ketosis should be differentiated from the true physiological ketosis since the treatment indicated is entirely different. This differentiation is not always possible without making an analysis of the blood. The author has observed a number of cases in which the urine gave a strong positive test and yet the blood sugar was high, showing that something other than ketosis was involved. Several such cases were found to be due to foot rot. To confuse the matter still further we do encounter true ketosis complicated by other abnormalities such as metritis and mastitis. These are not only the most difficult to diagnose but are also the most difficult to treat. Ordinarily the complicating ailment must be cleared up before the cow will respond to treatment for ketosis.

Since ketosis is associated with a deficiency of carbohydrate in the body and can be cured by the administration of sugar, many have suggested that the condition is due to a lack of readily available carbohydrate in the diet. Data was obtained from

a cow which developed ketosis even though fed two pounds of molasses per day for over a month before calving. Ketosis also developed in several other cows in the same herd on a similar diet. It appears, therefore, that adding molasses or sugar to the ration during the dry period will not prevent ketosis. However, feeding molasses or some form of sugar for a few days before and for two or three weeks following freshening should help to prevent the condition, as this is the time when the body must make its greatest adjustment due to the suddenly increased demands for carbohydrate and other nutrients for milk secretion.

In view of the fact that ketosis can be produced merely by limiting the feed intake during the critical period preceding and following calving, it would appear advisable not to cut the feed intake too much prior to calving and to increase the feed intake rapidly following calving. How this can best be done is one of the objects of a series of investigations on ketosis now under way at the Maryland Agricultural Experiment Station. Having produced ketosis experimentally, we are now seeking to develop a system of feeding and management, including special rations, which will enable dairymen to prevent this condition from occurring in their herds.

Seeds as Human Food

Condensed from Organic Gardening

Walter Siegmeister, Ph.D.

IN THE beginning, according to Genesis, mankind was ordained to live on fruits, herbs and *seeds*. Why seeds were included in the human diet has only lately become clear to us. It is not the minerals, or the proteins or even the vitamins in seeds that make them essential in the diet. It is their content of fat, especially of phosphorized fats known as lipins, chief of which is *lecithin*, which makes seeds so important in the human diet.

It is claimed by some that the active minds of the Russians are due to their custom of consuming large quantities of sunflower and pumpkin seeds, since these supply lecithin which is a brain food. That the fatty part of seeds, which is expressed in their oils, feeds and strengthens nervous and cerebral tissues is a physiological fact, and from this results the value of seeds as foods.

Lecithin, which has recently entered therapeutics as a nerve reconstitutent, is at present manufactured from the soya bean. However, all seeds contain lecithin, which is intimately associated with the vital functions of the germ or embryo of seeds.

One of the most valuable seeds in human history is millet. Millet is one of the most ancient foods of the human race, and still constitutes the basic diet of teeming millions in Asia and Africa. From the hot tropics to cold Manchuria, millet constitutes the chief food of the natives. Recent scientific researches have shown that of all grains, millet is the only one capable of maintaining animals in a state of health when fed as an exclusive food, due to its high quality protein and complete vitamin content. On other grains, various types of nutritional deficiency result when they form the exclusive diet. But on millet perfect health is maintained, for millet supplies all essential amino acids and vitamins. Two and a half thousand years ago, Pythagoras, the first great teacher of diet in the western world, praised the nutritional value of millet and advocated its use. The Pythagoreans lived on a vegetarian diet composed of millet, vegetables and fruits.

Another seed that Pythagoras recommended is sesame. In Turkey and the Near East, sesame constitutes a basic part of the

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diet, and sesame oil is used as a source of fat in place of butter and other fats. Sesame seeds are made into a number of delicious confections, most famous of which is "Halvah." There is no reason why sesame should not be grown in our country on a large scale. Pythagoras recommended a meal made of sesame. Recently in the Andes, I have been given a delicious sesame meal made by Indians of toasted sesame seeds ground between stones with toasted barley. They make a similar meal of toasted linseed.

A great number of various seeds, now neglected, will be cultivated and made a part of the diet as soon as nutritionists realize the great importance of lecithin in the diet. In the past, proteins have been overstressed, while lecithin has been neglected. Yet it appears that lecithin is the most important missing dietary factor which most people lack, and of which seeds are the best source. Seeds such as pignolia nuts, pistachio nuts, cashew nuts (a seed of the cashew fruit, and not a nut), Indian nuts, etc., should enter into the diet, as should pumpkin seeds, sunflower seeds and sesame seeds. Seeds supply, besides lecithin, cephalin and lipositol (three phospholipins present in nervous tissue), the nutritionally essential unsaturated fatty acids (linoleic and linolenic), which Burr and Burr proved to be necessary for normal health and which are present in no other foods except in seeds and their oils.

Recently, much publicity has been given to a certain seed, the soya bean. However, from the nutritional viewpoint, the soya bean is by no means the most valuable of seeds and other seeds, as sunflower seeds, sesame seeds, millet, etc., are superior. The reason why we say this is because the soya bean, with its 40% protein content, is often too rich in nitrogen for many people, who are unable to tolerate it, while all can eat the other seeds mentioned and handle them without difficulty, thereby obtaining their valuable lecithin content without the danger of an excess of protein, as when eating soybeans.

I predict that during the next few years, scientists will turn their attention to seeds and their nutritional value to a degree never done before. This will follow from the discovery of the great nutritional importance of the phosphatides, or phospholipins which seeds contain (such as lecithin), which are so important for the nervous system. As proteins and vitamins are emphasized in the past, so will the phospholipins, present in seeds, be emphasized in the future, and the cultivation and use of edible seeds will be given increased impetus.

Vegetable Cows

Condensed from The Dakota Farmer

THE Chinese "milk" a vegetable—the soybean—instead of an animal. Many an Oriental youngster has grown up without ever tasting real cow's milk.

For one thing, milk as we know it would be far too expensive for the Chinese. Soybeans can be produced on less ground and at only a fraction of the cost of maintaining dairy cattle.

The beans are "milked" in a number of ways. Here is one of them, one that has been utilized in this country in experiments with the "wonder bean." First the beans are washed, then soaked overnight. The skins or hulls are rubbed off in the water —as they loosen they rise to the surface and are discarded. The hulled beans are then ground in a food grinder, put in a cheesecloth bag, and again placed in water. The bag is squeezed and worked by hand for some ten minutes, the water turning into a creamy white liquid in the meantime. The bean pulp thoroughly worked, the bag is squeezed dry, after which the bean milk is boiled over a slow fire for half an hour. Sugar and salt may be added to improve the flavor.

Though not equal to cow's milk in food value, this vegetable milk contains most of the same food elements in somewhat smaller amounts. Like cow's milk, it may be used as a beverage, and in making custards, soups, drinks like cocoa or hot chocolate, or in baking breads and cakes. Soybean curd and cheese are other products widely used by Oriental peoples.

Known in China since before 3,000 B.C., there is a legend to the effect that a robber band caused the value of the soybean to be discovered. The brigands besieged a caravan of merchants in a mountain canyon. The latter, defending themselves valiantly, were able to beat off their attackers but after some days ran out of food. It seemed as if starvation would force their surrender. But someone noticed many small plants with pods—wild soybeans. The beans were pounded into a coarse flour, mixed with water, and baked into cakes. And by means of this food the caravan was able to hold out until help came.

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Are You as Good as Your Land?

Condensed from The Southern Planter

Dr. T. B. Hutcheson

Dean of Agriculture, V. P. I.

THOUGH we have never fully agreed with the often repeated statement, "there is more in the man than there is in the land," we readily admit that poor management is one of the frequent causes of low income from farms. The best management cannot wring profits out of crops planted on unfertile, unadapted soil types, but it can reduce losses even there. Among the more important managerial factors that influence profits on farms are choice of enterprise, timeliness of operation, proper fertilization, choice of varieties, utilization of equipment, and management of labor.

In order to be a successful farmer, one must not be overinfluenced by his own likes or dislikes. One can usually learn to like any business that pays. This is evidenced by the fact that in the Washington milk shed and around the larger cities, farmers as a rule like to work with dairy cows; in Southwest Virginia, they like beef cattle and sheep; in the upper valley, they like to work in the orchards; in the Harrisonburg area, they like poultry; in southside Virginia, they like to produce tobacco; in the peanut section, they like hogs; while on the Eastern Shore, they prefer truck. This is simply another way of saying that as a rule, these are the best paying enterprises for the respective sections.

On most farms, there should be one or more major enterprises, and these should be supplemented by supporting enterprises that give a proper diversification and a relatively uniform distribution of labor. Of course, these enterprises should be adapted to the soil types and climatic conditions of the particular farm, as well as to the market possibilities for the product. In lieu of more specific information, the best guide to the choice of an enterprise is what the better farmers of the particular area are producing.

It is rather surprising to find how easy it is to pick out the best farmers of a section by simply driving along the roads and observing what they are doing at any particular time. These farmers are usually up with their work; plowing well ahead of time; turning in cover crops at

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least thirty days before planting; hauling out manure and shrubbing pastures during the winter; and planting as soon as the proper date arrives.

We sometimes think it is a disadvantage to have too much time in which a job may be done. For example, corn may be planted any time between April 15 and June 15 in eastern Virginia, and have time for full maturity; while at the higher altitudes of western Virginia, it must be planted between May 1 and May 20 to insure maturity before frost. However, as a rule, the western Virginia farmers produce more corn to the acre, get through planting sooner, and cultivate the crop cleaner. Procrastination is not only the thief of time, but may be the thief of profits!

Those farmers who complete any job in the first half of the period in which it may be done are usually the best farmers of the community. In order to do this, it is necessary to plan ahead and watch the work calendar carefully. This means being careful to see that the production plan does not propose more work than can be done efficiently and on time by the labor that will be available. The production of large acreages of poorly handled crops of low quality is rarely profitable, even in periods of high prices, and may show a decided loss when prices are low.

Of course, no amount of planning, timely operation, nor good management can make an unproductive soil profitable. In fact, good management implies seeing that the soil contains ample plant food to produce the crop. The real measure of the value of any soil is the amount of available plant food it contains. The average corn yield of Virginia varies from 24 to 29 bushels to the acre. The principal cause of this poor yield is poor land. It would be easily possible to increase this to 40 bushels to the acre if every grower fertilized liberally and according to the requirements of the crop. If this were done, Virginia could produce its present crop on fewer acres and with considerably less labor. In fact, one cannot afford to use labor at present prices to cultivate poor land. There is more fertilizer data available from the Agricultural Experiment Station through county agents and other agricultural workers than can be had on any other farm subject.

It is hardly necessary to say much about the importance of good breeds or good varieties of good seed. It is, perhaps, sufficient to say that there may be as much as a 20 per cent difference in the yield of the different varieties of the same field crops sold in Virginia. It is extremely important that we be well informed about the adaptability of the dif-

ferent varieties for our particular conditions.

It has been frequently said that the invention of any labor saving machine makes competition harder for those who do not have the use of such machines. It is therefore, important that our farms be equipped as fully as practicable with modern machinery. However, it should be remembered that there is no virtue in saving labor unless something useful is done with the labor saved. Of course, tractors and other heavy machinery save labor. However, on many small farms, horses kept for cultivating crops and man power available have plenty of time to do all of the farm work if a little planning ahead is done. In such cases, it would be wasteful to make heavy investments in machinery. With machines, as well as men, it is necessary to have plenty for them to do before investing much money in them.

There is no rule that always applies to the management of labor. This varies with the employer and the employed. Generally speaking, comfortable housing, reasonable working hours, fair play, some time for recreation and courteous treatment will go far toward keeping labor satisfied. One of the important jobs of the employer is to see that the employee gives the major part of his time to productive work, and that little time is given to unessentials or work that can be done by cheaper labor.

The Popularity of Sweet Sudan

Condensed from Seed World

SWEET SUDAN definitely is on the upswing. Farmers and dairymen who made trial plantings last season in southern and eastern states have issued enthusiastic reports. Planted next to common Sudan, it was grazed down to the ground while the older strain was almost completely ignored.

This newcomer is surpassing common Sudan which itself made a surprising showing after it was imported from Africa in 1909. Common Sudan had its drawbacks even though it proved to be outstanding for hay and summer pasture. For one thing, it was susceptible to plant diseases such as anthracnose, leaf spot, kernel smut, leaf blight, bacterial stripe and bacterial streak. In addition, common Sudan's seed resembles that of Johnson grass so closely that only a trained seed analyst can detect the difference. The two grasses have almost identical seed except for that of Sudan grass being larger and more plump. No machinery has ever been devised for separating the two kinds of seed and as a result, many farmers will not plant Sudan for fear of polluting their fields with Johnson grass.

Because of these drawbacks, a better strain of Sudan grass was clearly in order. Breeding work for a new and better Sudan grass was started several years ago in Texas. Dr. R. E. Karper of Lubbock, agronomist in charge of sorghum investigations for the Texas Agricultural Experiment Station, and J. R. Quinby, superintendent of the Chillicothe substation, embarked upon a long program of crossing, back-crossing and careful selection with hybrids between Sudan grass and sweet sorghums.

Their research work was culminated in 1937 when they announced Sweet Sudan grass. This hybrid is a cross between common Sudan and Leoti, a sweet sorghum. The Sweet Sudan has the grassy characteristics of the parent Sudan but also combines the desirable qualities of sweet and juicy stalks, disease resistance, and the distinctive reddish-brown color of the seed husk or glume. The latter quality is very important, for it enables seedsmen and farmers to distinguish Sweet Sudan grass from that of Johnson grass seed.

Another favorable characteristic is the fact that Sweet Sudan's

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seed heads do not shatter as easily as those of common Sudan. This is an important factor in the Plains Country of Texas where Sudan grass seed is an important cash crop. Often millions of pounds of Sudan seed are lost because of cool fall harvesting or an early frost. When combined with a strong wind, these factors cause the panicles to shatter very easily.

Sweet Sudan is also more resistant to bacterial leaf spot and charcoal rot than is Common Sudan. Chinch bugs do not relish it to the same extent they do the common strain.

Sweet Sudan was grown in almost every state this year. In addition, many foreign countries tried it out. Several fields were harvested for seed in Maryland and West Virginia. In addition, farmers in California, Arizona, Kansas and Oklahoma were reported growing considerable acreages for seed crops of Sweet Sudan.

Many farmers in the East and South grew Sweet Sudan for the first time this year. Among the first growers east of the Mississippi River to experiment with this crop is L. R. Neel, superintendent of the Middle Tennessee Experiment Station. He, too, believes Sweet Sudan has a very promising future but warns against permitting livestock to graze it too heavily. He recommends removing cattle when the grass is eaten to within six or eight inches from the ground.

In view of all the favorable reports on its performance, it appears that Sweet Sudan has won for itself a definite place in the ranks of outstanding forage seed crops.

Wilmarth Pioneers with Baby Capons

Condensed from Better Farms

Cecyl White

IT CAN'T be done—they told Walter Wilmarth. But he didn't believe it.

Even when all the state and agricultural colleges told him it was impossible, and all the poultry breeders and experts told him more or less politely that he was crazy, and technicians employed by the big feed companies practically laughed in his face, he still wasn't convinced.

So because of one man's belief in his own idea something "new under the sun" has been developed and a new agricultural industry is well on the road to world success and fame. This new business, developed by Walter F. Wilmarth, on his farm in the foothills of the Blue Ridge mountains about two miles from Kingsley in Susquehanna county, Pennsylvania, has several ramifications, but the most sensational is the caponizing of three weeks old cockerels.

Mr. Wilmarth is not only the originator of this idea of de-sexing baby chicks, he is the only man in the world who can perform this delicate operation successfully. After experimenting over a period of more than two years and killing some 3,000 chicks in the process, he has arrived at the high point of skillfulness where he can caponize between three and four chicks a minute and his average fatalities are less than one bird in a thousand.

The most obvious advantage of starting with a chick so young is that the stepped-up growing period during which bone structure and meat are developed begins so early in the chicken's life span. Usually, caponizing is done when the cockerel is between eight and ten weeks old and weighs around a pound and a half. Invariably this means a halt of about a week in the steady growth of the fowl and the bone structure is already so well set that the bird never develops the size and weight of those which get their start four to six weeks earlier.

"But why capons anyway?" Mr. Wilmarth has been asked many times, and to this he has two answers. First, the capon fills in that vacant place in the fowl line between a broiler and a turkey. A broiler is frequently too small for a family's requirements

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—a turkey too large. The only answer, in most cases then, is a hen, stringy, savorless, with too much pale fat, or a rooster. In size, a capon fills that lack of a medium fowl.

In the second place, the flesh of a capon, in comparison to a hen or rooster of the same approximate size, has the same superiority of flavor and tenderness that steak from a prime western steer has to that of a milch cow or a two-year-old bull.

"I thought people might be interested in growing capons if they could get them," Wilmarth states matter-of-factly, "but you can't ship chickens to advantage when they are more than four weeks old. So I began to wonder if chicks couldn't be caponized at two or three weeks of age."

Then began the search for information. He wrote letters and he traveled. Whenever he heard of anyone who might be likely to know the intricacies of caponizing baby chicks, he contacted them. He received only one answer. "It can't be done."

Deciding that because it never had been done was no final proof that the operation was impossible, he began experimenting. In the first place he discovered there were no instruments manufactured such as he would need. He designed some and had them made. The first ones didn't work so he designed others. He tried electricity. That wasn't successful, either. Finally he reached the place where he could perform the operation successfully in about half an hour.

"A single chick is of such small monetary value," he explains, "that the only possible profit lies in a rapid and numerous turnover. There could be no money in caponizing three weeks old chicks if it required half an hour to handle each bird." The experimenting went on, but now he knew he was on the right road.

When he finally developed his skill so that he was partially satisfied with his proficiency, he began looking around for a market. That first year, 1938, he only sold 3,500 baby capons. In something less than seven years he has built that small start up to a total of 150,000 sold last year and an average of 3,000 per week this year.

Mr. Wilmarth has no breeding program. He is not interested in that angle. He buys day-old cockerels, New Hamphire and Barred Rock cross, from a Connecticut hatchery. "I am trying to find a better cross than the birds I am now using," he confesses.

When the chicks arrive they are placed in banks of pens with several times the headroom usually allowed for chicks their size. One of the chief foods is condensed buttermilk with cod liver oil, fed consistently until the caponized birds are shipped out at

the age of four weeks. "We are handicapped in the matter of feed, too," explains Mr. Wilmarth. "No feed company has developed a growing mash for capons so I am using turkey mash."

He finds that no experimental work has ever been done in trying to develop a better type of bird for caponizing or in creating a feed that will build the bone and meat required in capons. He is doing some of this experimenting himself.

"There is a big difference between growing a broiler and growing a capon," he illustrates. "On a broiler you must grow meat early, but in a capon you must grow bone first to carry the weight. If you fed a broiler mash to develop w e i g h t, its legs wouldn't hold up."

When the chicks are a week old they have moved into the next pen and the place they vacated is taken over by new arrivals of day-olds. Each week they are moved up to the next pen. When they are three weeks old they are caponized. When they are four weeks old they are shipped out. Consequently in the constant rotation, one of the five similar pens with which the farm is equipped, is always empty. This gives a chance for each pen, once in four weeks, to be thoroughly scrubbed out and disinfected. As an added precaution in disease control, each pen is equipped with sterilamps which kill all airborne germs.

Each pen is also air conditioned. A system of forced draft that completely changes the air in each pen every twenty minutes has been worked out with men from the Penn State College. "We don't set the system by a thermometer," explains Mr. Wilmarth. "We watch the chicks."

There is absolutely no odor in the pens, which are painted four times a year, and this summer the government used the Wilmarth farms in experiments with DDT. "It was wonderful," Walter laughs. "We didn't have a single fly." This was the only poultry farm in the state used as a proving ground for this new spray.

"I don't like to overcrowd my chicks," he declares, and the banked pens are arranged so that each baby has one-half square foot of space. When they are two weeks old, and moved for the first time, they are changed to rooms with a capacity of 1,500 each and put in pens with a capacity of 375 each. "I try to approximate floor conditions and get away from hot-house chicks," he goes on, explaining that he wants his little capons to be able to survive and grow in whatever coop conditions their purchaser places them.

When the little cockerels are three weeks old, Mr. Wilmarth and his assistant go to work on the operating job. It is work

which quickly builds up nervous exhaustion and Mr. Wilmarth only keeps at it for about four hours a day. Even so, he finishes up a pen of 1,500 in two working days.

As soon as the fast operation is finished, the bird is placed back on the floor with its fellows and begins eating immediately, suffering no apparent shock or discomfort and there is absolutely no halt in its growth. Quite the contrary. In the seven days immediately following the caponizing, the birds just about double in size and the difference in alertness is quite remarkable. After being shipped to the grower, it takes about six months for one of these fowls to reach maturity and a weight that averages nine pounds but sometimes goes as high as eleven or fourteen.

Besides some 30,000 four weeks old pullets sold from the farm each year, and started like the capons, Mr. Wilmarth also raises some 3,000 or so of his own capons to adult age for sale to the Thanksgiving market. These birds are placed on range during the summer months, and here, too, he is experimenting. Ladino clover, used so extensively in New York state for pasture, is one of the best types of grass for his chicken range, Mr. Wilmarth has discovered. Penn State College, following his lead, is experimenting along this line.

He uses A-type range shelters —has about 40 of them—with wooden floors, no roosts and knee-deep litter. He finds that it takes about five pounds of feed to make one pound of gain on a capon. These birds don't range as widely as turkeys and if he can just find the right kind of cross-breed, that will make more economical use of feed.

Sales of the four-weeks-old capons have all been within the United States, although they have gone to every state in the Union and especially to Florida and California. Now that war restrictions on shipping are easing, Mr. Wilmarth is considering trying to send the little capons to Cuba, where several buyers have been begging for them for some time. The largest shipment was 10,000 capons, but most of them are a lot smaller.

The Agricultural Society of Paris, France, is also very much interested in the work which Mr. Wilmarth is doing and has offered all the information on chickens which it has in exchange for Mr. Wilmarth's secret of caponizing a chicken when it is less than a handful.

Cater to Cow's Taste by Soil Treatments on Pastures

Condensed from Guernsey Breeders' Journal

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WHILE we are emphasizing the use of more grass as cover for the soil against erosion, we are subconsciously including more cows as the means of converting that herbage into human food values. It is, of course, high time to practice more conservation of the soil, but it is also necessary to design any enlarged program of grass production so that it will cater to the cows' tastes as well as cover Nature's nakedness.

During any campaign for more grass, it is fitting to ask the question whether we are catering to the cow's tastes when thin, infertile, eroding lands are put to grass of any kind merely for the sake of cover. Shall we not emphasize the function of the grass as feed for the cow more than as blanket protection against falling raindrops and as miniature dams against water running in rivulets? Isn't the production of highly nutritious forage the primary function of putting land into pasture; and isn't the saving of the soil the secondary one when by proper soil treatments the primary function can be carried out and the secondary one can be accomplished simultaneously without extra cost?

When Pastures "Run Out"

Whenever a part of the farm has some topographic features to make the use of larger machinery difficult, or if its productivity is making economically questionable the yields of seed crops under tillage, we are prone to consider putting it down to grass. If a fairly respectable sward results in the early years of such a program, it is usually not very long before the pasture is "taken by the weeds" or considered to have "run out."

When such conditions result, we are inclined to search for some new grass crop that will give tonnage production again where the bluegrass or preceding combination of pasture plants could no longer survive. When weeds take over the pasture, we often consider mowing as a good help to

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restore grass by eliminating the weeds as competitors for soil moisture along about mid-summer.

That the cow's taste enters into this weed problem in pastures because the declining soil fertility gives lowered feed quality in the pasture crops may, at first thought, seem far-fetched. But what is a weed in the pasture, after all? Isn't it a kind of plant which the cow will not eat? Should we not think of it as one that can make only woody bulk refused by the cow because the soil isn't fertile enough to grow the more nutritious herbage which the cow takes regularly? In Nature it is the forests or woody crops that occupy the soils which are thinnest and not so productive when cleared and put under cultivation. Can't we believe that the cow is allowing the weeds to grow because they are not producing anything worthy of her consumption for its nutritive value? If she refuses to mow the weeds, her seeming fastidious taste is telling us that our running the steel mowing machine over the pasture is not striking at the crux of the problem of getting good grass as she judges it.

When pastures go to weeds, nature is merely adjusting the crops by bringing in those that can make their growth on less of the soilborne nutrients that are essential for animals and plants. Weeds are made more extensively of air and water which are fuels rather than real nutrition. The mowing machine cuts down the plants the cow refuses to eat. But it adds no new supplies of lime, phosphorus, nitrogen, potassium or other essential elements that would encourage the dominance of plants like bluegrass and legumes using these soilborne nutrients in manufacturing the higher feed values the cow prefers as she demonstrates in her preferential grazings. Pasture renovation calls for other machines in addition to the mower. It calls for the manure spreader or the lime and fertilizer distributors, as the cow's taste tells us.

The grazing animals have so often demonstrated their discriminating tastes that most any farmer can report startling observations of the choice by cattle between forages according to differences in the fertility of the soils growing them. Usually the animal takes first, in the humid regions, the forage where the soil was limed, given phosphate, manured or made more fertile in some way. Observations of such were reported by E. M. Poirot of Golden City, Missouri, when his beef cattle grazed first the small parts of the barley field where in drilling out the corners he doubled over and thereby applied 200

pounds of mixed fertilizer in contrast to only the 100 pounds put on the rest of the field.

Choices by the cow and other animals are apparently not so often the cases where only one nutrient element is applied. They are probably more often cases of the better balance of several elements through which the feed output by the crop fits better into the animal physiology that is registering its needs by way of the animal's discriminating taste. Almost everyone is familiar with pasture scenes where there are bunches of the tall green grass resulting from the nitrogen dropped there in urine from the livestock. The cow disregards these bunches to let them grow taller while she eats the short grass around them still shorter. That the cow recognizes the lower feeding value of grass with this excessive and unbalanced fertilizer treatment is suggested by the failure of experimental rabbits to do well when fed grass similarly fertilized while their litter mates did well on the same species of grass not fertilized with liberal amounts of this one element alone.

When the shelled grains of corn from a series of plots producing different amounts of sweet clover turned under as nitrogenous green manure ahead of this crop were put into separate compartments of the self-feeder for hogs, the animals exercised an interesting selection. With one hundred pounds of grain in each compartment representing one particular plot of the series fertilized to give more clover growth turned under, the relative rate of corn consumption was measured. This consumption rate decreased as the extra soil treatments gave greater amounts of sweet clover turned under as green manure. The corn from the plot with no soil treatment and therefore little sweet clover turned under was most highly preferred. However, when red clover was the green manure, their relative selections were reversed. Their consumption rate was highest where soil treatments gave the largest amounts of this green manure turned under. These differences demonstrate variable responses by the animal's taste according to the nature of the nitrogenous fertilizer turned under for the corn. Seemingly one is a balance and the other an unbalance for them.

Here are the suggestions that plants grown on the better soils in terms of general balance of fertility are chosen by animals because of greater nutritional service from them. When plants as forages, or even their seeds, are not taken by animals, there is the suggestion that the soil is of low or of unbalanced fertility from which the vegetative growth

cannot compound those substances of most nourishing services. Catering to the cow's taste by treating the soils to grow grass crops according to her likes may be a kind of soil building under the guidance of a highly refined animal assay rather than under that of the laboratory chemist. Taking the cow's tastes into consideration would seemingly lead us to a better pastoral agriculture, when the measure of it is taken in terms of meat and milk.

We have not yet come generally to believe that by feeding lime and other fertilizers into our soils we make them healthy soil bodies to the same degree as we believe for our own bodies the old adage "that to be well fed is to be healthy." Yet, when it is almost axiomatic that there is much immunity to infectious disease in our good health, might we not consider that good health of soil through fertility may represent in it an immunity to invasion or "infection" by weeds? For if soils are well stocked with all the necessary elements of fertility, they will encourage rapid growth of dense cover of the planted, desirable grasses with which weeds cannot compete. On such soils the fertility diet for the crop is one that encourages the plants which are given to synthesizing the complex compounds of highly nutritional value and thereby those that satisfy the supposed idiosyncrasies of the cow's tastes. Does this not suggest that an insufficient soil fertility, or poor diet, for crops gives weeds and thereby a poor diet for the cow in terms of her choice and her output of food products for us?

Sanborn Field with its 55 years of cropping history at the Missouri Experiment Station recently demonstrated the fact that high fertility in the soil may well be considered an immunity to weeds, while soil exhaustion may be manifested by an increasing susceptibility. Two plots in this old field have been in timothy continuously since the start of the field in 1888. One is given six tons of manure annually. The adjoining plot gets no return of any fertility. Both have hay taken off every year.

While the timothy under regular manure treatment grows well and excludes the weeds, the plot with no manure starts off with a good stand after each occasional reseeding following plowing. But it is gradually taken by weeds. Consequently it demands plowing and reseeding of both plots about every 6-8 years in the attempt to keep them more nearly comparable as timothy stands.

This shift during about 6 years from timothy to weeds in this plot which is cropped continuously but given no return of fertility or no manure, suggests a greater susceptibility to weed infestation.

This was demonstrated forcefully by the advent of broom sedge (Audropogon virginicus) a few years ago when this plot was approaching the eighth year following the last plowing and reseeding. The weedy hay crop of a ton and a quarter taken in June was followed by a broom sedge crop of 3200 pounds per acre in late October. These combined annual weed productions were a tonnage yield greater than that of fine timothy hay in July on the adjoining manured plot. Yet had the cow been permitted to exercise her choice she would have classified the latter crop of lesser tonnage as good feed and the former of greater acre yield as weeds and not as feed.

Only this one plot amongst the forty or more plots with all the different fertility treatments on this experiment field had become susceptible to an infestation by broom sedge. Can we say that the winged seeds that started this weed crop were dropped on this plot alone and not over the borderlines that separate it from the plots adjoining? Can we imagine that the light feathery seeds of the "Old Man's Beard," as this weed is often called, were not scattered over the entire field at the same time they were seeded on this plot?

Here is encouragement to believe that infestation by weeds may be viewed as a case of our neglect of the fertility of the soil rather than the visitation of a great evil upon us. The applications of manure, lime, and other fertilizers may well be considered as a prevention of weeds at the same time that they are helps in providing more and better animal feeds.

Consider the Cow While Considering the Crop

Unfortunately, the tonnage yield per acre has been the prominent criterion that has guided our search for, and selection of, forage and grass crops. When one crop has gone down in its yields we have brought in other crops, mainly because they gave more pounds or tons per acre. Such has been the story of the introduction of some forage legumes, originally quite foreign. Consideration has not gone to the crop's capacity to cater to the cow whose taste is concerned and whose service as a provider of milk or meat as well as a regular multiplier of her own kind are at stake. She is, after all, the final criterion that must come in to determine what services will be rendered by the crop that must be consumed by her and thereby converted into human food products.

The grass crop is good mechanical help against erosion in terms of its services as soil cover. But as a cover it cannot be laid on the land except as the fertility of the soil grows it there. This

same soil fertility determines how serviceable grass will be as a feed for the cow that converts it into cash. It is primarily this latter function for which grass is grown. It is essential, thereby, that the applications of soil fertility for growing more grass as soil cover be guided toward making better feed of it by catering to the cow's taste through soil treatments. For the dairy cow there may well be considered the same philosophy of feeding as was suggested for the hog by Professor J. M. Evvard when he said, "If you will give the pig a chance, he will make a hog of himself in less time than you will." The cow, too, may classify under this category if we cater to her tastes.

Boys' Town — Ranch Style

Condensed from the American Magazine

To date, Cal Farley, of Amarillo, Texas, has given some 233 boys between the ages of 6 and 14, a ranch and a second chance. These kids, 44 at a time, most of them from crowded cities, and a majority of them either so-called problem kids or boys from destitute homes, are being allowed to be real cattlemen in the great, big outdoors of Texas. The ranch is called Boys' Ranch, and Cal founded it back in 1938. Originally, Cal had been a second baseman in a ball club in St. Paul, Minn., and a professional wrestler. Then, in 1923, he went to Amarillo, settled down, opened a garage, and made good. Always wondering about what happened to kids who went wrong, Cal decided to have a go at trying to give them the chance they deserved. He went to a wealthy rancher, got him to donate the land. Cal and some businessmen put up the money. The ranch has been rolling along ever since. Though it is a little early yet to record that any of its boys have gone out and set the world on fire, the graduates have made a wonderful war record. And most of the kids are already justifying Cal's faith in them. Next year he hopes to take in 80 boys instead of 44, and expects some day to get boys' ranches started in other sections of the country.

The Blackberry — A Neglected Fruit

Condensed from The Rural New-Yorker

John S. Bailey

TWENTY-FIVE or 30 years ago, the growing of blackberries was of commercial importance in the Northeast but its culture has gradually declined until today a commercial blackberry grower is almost a curiosity. The blackberry is such a sweet and tasty fruit when thoroughly ripe and is so easily grown that it seems too bad it should be thus neglected. The very ease with which it grows is probably partly responsible for its undoing. Ordinarily so vigorous and persistent is its growth that suppression or direction is more important than stimulation.

Any blackberry planting soon becomes a briar patch unless continuous and strenuous effort is made to prevent it. This is accomplished mostly by proper pruning and cultivation. Blackberry canes grow and form flower buds in the first year; then fruit and die in the second. Therefore, the old canes may be removed as soon as the crop is harvested. If they are not removed in the Fall, they should be cut out the following Spring. Next, broken and weak canes should be removed, those remaining thinned out until they are eight to 10 inches apart, and the row narrowed to about one foot. The laterals, or branches, on the remaining canes will need to be reduced in length in order to thin the crop and increase berry size and quality. Since varieties vary in the position of their flower buds, the amount cut off the laterals will have to be varied accordingly. The laterals of the Eldorado and Snyder varieties should be left about 18 to 24 inches long. If blackberries are grown in the hill system, three or four canes are enough for each hill.

Another very important part of the pruning operation is the pinching of the new shoots in June. When they reach a height of two and one-half to three feet, their tips should be pinched off to induce the formation of laterals, thus producing strong stocky plants rather than long sprawling canes. The planting will need to be gone over several times at weekly intervals, since not all shoots reach the desired height at the same time.

The blackberry is a shallow-rooted plant. Therefore, cultivation needs to be shallow or many

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roots will be cut, thus causing the plants to suffer from lack of nutrients and of water, particularly late in Summer when the rainfall is apt to be light and the fruit is ripening. Also, the cut roots will send up a forest of suckers which make it more difficult to maintain narrow open rows. Cultivation, where practiced, should be started as early in the Spring as the ground can be worked and continued until the crop is harvested. A cover crop of either barley, oats or buckwheat, sown following the harvest, takes up excess moisture and nutrients, thus helping to harden off the canes for Winter, and adding organic matter to the soil.

Some growers practice mulching either over the whole planting or in the rows with cultivation of the middles. Mulching with such material as straw or waste, coarse hay has several advantages: conservation of moisture, addition of nutrients and organic matter, prevention of erosion, and reduction or elimination of cultivation with a consequent reduction in suckering. Its main disadvantages are cost of mulch and some fire hazard. Enough mulch should be added at two or three year intervals to keep down weeds.

On a good blackberry soil little or no fertilizer may be needed. Where growth is not satisfactory, stable manure, used at the rate of 10 to 20 tons per acre, is excellent. Poultry manure is also good but, because of its higher nitrogen content, must be used at about one-half the rate of stable manure. If manure is not available, any of several nitrogen carriers may be used. Sulfate of ammonia or nitrate of soda at the rate of 250 to 300 pounds per acre is generally satisfactory. Since blackberries do not respond to a direct application of phosphorous or potash, these can be used to better advantage if applied to the cover crop just before seeding. Six to eight hundred pounds of a 4-12-4 is about right for soils of average fertility.

One of the worst enemies of blackberries is drought; hence, great care should be exercised in selecting site and soil. While the blackberry will grow on a wide variety of soils, a deep, moist but well drained, fertile loam, well supplied with organic matter, is needed for good growth and heavy fruiting. Although a constant and adequate water supply is necessary, a waterlogged soil is not good, because blackberries will not tolerate wet feet. A site on a gentle slope is best, for it provides good air and water drainage. A north slope is cooler and dries out less than others during the hot dry days of the harvest season. The protection of a windbreak is also helpful.

Another reason that less acres are grown to blackberries is the lack of really good varieties and the difficulty of getting varieties true to name. The short variety list has only one, the Eldorado, recommended for general cultivation in the Northeast. The plants of Eldorado are hardy, vigorous, productive, and much less susceptible to orange rust than other sorts. The berries are large, elongated, and jet black with a soft core. Their flesh is moderately firm, juicy, sweet, and fine flavored when well ripened. They ripen over a long period in midseason. Alfred, another relatively new midseason variety, seems worthy of trial. While some think it is not the equal of Eldorado in hardiness and productivity, it is conceded to be better than the other kinds. The plants are vigorous, medium producers, and fairly hardy. The berries are large, cylindrical to cylindrical conic, black, juicy, firm, also sweet and flavorful if well ripened. Snyder is one of the hardiest of all blackberries, but recommended only for locations where Eldorado is not hardy. The plants are vigorous, heavy producers, and grow better on poor soils than others in the list. Its berries, however, are small, roundish, black, quickly becoming blackish-red or brownish-red, and soft cored. The flesh is firm, juicy, and fair flavored. It ripens in midseason. Blowers is an inferior variety.

Blackberries are troubled by few serious insects and diseases. Orange rust is caused by a fungus which grows all through the plant and lives over from year to year. In Spring the new leaves of infected plants are yellow on the under side. Later, the leaves are covered with orange-colored pustules. Infected plants should be pulled and burned. The best protection is the planting of the resistant varieties. Crown gall is caused by bacteria which can live over in the soil. It is characterized by large, rough, irregular swellings which usually appear on the roots but may be at the base of the canes. Since this organism attacks the roots of several fruit plants, blackberries should not be planted where infected berries, grapes, or tree fruits have been removed until several years have elapsed. Only disease-free stock should be planted. Sometimes red-necked cane borers, by their tunneling, cause irregular swellings one to three inches long on the new canes, usually near the base. Such canes are often weak and unfruitful; they should be removed and burned when the dormant pruning is done. The female of the tree cricket sometimes weakens canes by making long rows of punctures in which she lays eggs. If such infested canes are re-

moved and burned during pruning, this insect will be held in check.

Blackberries in prime condition are really a delicious fruit. The public's lack of enthusiasm for them is due to the way they are usually handled for the fresh fruit market. They are picked when firm enough for distant shipping. In this condition they are too sour and lacking in flavor to please most tastes. When fully ripe, they are too soft to ship. However, if sold at a roadside stand or on a local market, they can be picked just before they soften. Handled in this way, the flavor is much improved This fruit consequently offers a good opportunity for roadside trade. But to be really "tops," they must not be picked until fully ripe, when they are soft and almost fall off the bush. They can be picked on order, and sold at a premium as bush ripened berries. Until better varieties are developed, such a treat is reserved for those who grow their own or buy them direct from the grower. Fortunately, better varieties are on the way, as the result of breeding work now being carried on by the New York Agricultural Experiment Station, Geneva, New York.

Food Before Feed

M. E. Ensminger

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How would you like to sit down to a festive board piled high with a grain diet of wheat, rice, soybeans, and barley; but with the king of foods, meat, conspicuously absent? Most Americans wouldn't like it. Even so, it would be better than going hungry and after all, some of the largest wild beasts of the jungles are herbivorous, or vegetarian, as we would say.

Today, starvation in Europe is imminent. We are being urged to come to the rescue through drastically reducing livestock numbers and going on an Asiatic type grain diet. Unfortunately, altogether too much of this clamor is not based upon facts, or at best, it is merely supported by half-truths.

There can be no question about the fact that more hunger can be relieved with a given quantity of grain by completely eliminating animals. One economist has estimated that if the use of crops for livestock feed were largely eliminated and we subsisted on crops alone, we would now have enough food for our more than 130,000,000 people of the United States for almost four years. The veracity of this statement cannot be questioned. When fed grains alone, about 12 to 15 pounds of concentrates must be supplied to livestock in order to produce enough meat and other livestock products to support a man for one day, whereas two or three pounds of grain (corn, wheat, rice, soybeans, etc.) eaten directly will support a man for a day. Thus, a given quantity of grain will support several times the number of people if eaten directly, rather than fed to livestock and the meat from the livestock eaten. This is precisely the reason why the people of the Orient have been forced into becoming vegetarians. However, we must recognize that the people of this country will not allow any such complete shift to an Asiatic grain diet to occur. This would be contrary to the standard of living which our armed forces fought to preserve. Moreover, it would not be making the most efficient usage of our American resources —particularly the pasture and range areas and inedible concentrates and by-products.

During the dark days of the war, the plea went out to the American farmers and ranchers

to produce meat as never before. Huge quantities of this highly nutritious and palatable food, so we were told, were needed as a morale builder for Uncle Sam's officers and men scattered at posts throughout the world, for our fighting allies, and for our war-geared civilians at home. The producers rose to the occasion. Meat production in this country climbed from nineteen and one-half billion pounds in 1941—the outbreak of the war—to an astounding all-time high of twenty-four billion seven hundred million pounds in 1944. This achievement was made by hard sweat and toil and despite many obstacles, not the least of which was lack of competent labor, and it was done without the benefit of parades or medals. A fine tribute, indeed, to loyal and ingenious rural citizens in a democracy.

Now there is an about face! The clamor is to drastically curtail livestock numbers and feed the world on an Asiatic grain diet; food for human beings rather than feed for livestock. The Secretary of Agriculture has recently been widely quoted as saying that we cannot ignore the fact that we can take care of more people by direct feeding of grain than by using it to produce livestock products for human food. Others are joining the crusade, and unfortunately, altogether too many of them are basing their assumptions entirely upon school boy arithmetic relative to the greater efficiency of feed utilization—a simple comparison between using grain as a food and feeding it to animals to be converted into meat, milk, and eggs. Threats of tampering with pledged livestock and grain ceilings, appeals on behalf of the starving Europeans, and well-oiled propaganda are being used to harangue and haunt those same livestock producers who so valiantly met a war-time meat crisis. Naturally, the six million farmers and ranchers of the country — the vast majority of whom are livestock producers—are puzzled. The other cheek has been smacked!

Yes, starvation in Europe is imminent. It has been estimated that 100,000,000 people in these war-torn countries now are receiving an average of only 1,500 calories per day, whereas the very minimum should approach 2,500 calories. By way of comparison, the average American citizen consumes an average of 3,300 calories daily. From time immemorial, starvation has taken its annual toll in the Orient. Only when the proportions reach into the millions, however, is it referred to as famine. Thus, it is no exaggeration to say that millons of people throughout the world now go to bed hungry each night. In recognition of this fact,

every farmer and rancher will help all he can. He is a humanitarian and his heart goes out to the starving peoples of the world. Nevertheless, we must not become panicky in these times. A crisis has arisen, and it must be met. The question is how.

If a ship-wrecked person were to find himself on a barren island with a pig and a bag of corn as the only food in sight, no doubt he would kill the pig and eat both the meat and the grain. If, however, there were a considerable amount of humanly inedible material which would be suitable for the animal, and only a little of the corn would be required as a supplement for the pig, sound judgment and ingenuity would probably result in a compromise program—a sharing of the corn by the man and the pig and a propagation of more animals. This simple example is illustrative of the post-war program of the livestock producers of the nation, and every American citizen should have a crystal clear understanding of the situation. Moreover, it must be recognized that we cannot have a prosperous America without a prosperous agriculture.

Doctors, lawyers, merchants, chiefs must be aware of the fact that about two-thirds of the feed used by livestock is not fit for human consumption. In this category are hay, pasture, mill feeds, and other by-products which are converted into meat, eggs, milk, and wool. It is also to be pointed out that beef cattle and sheep have always existed largely on forage, it being estimated that 80% and 95% respectively of their total feeds is derived from roughages. Over 60% of the land area of the United States is pastured at least part of the year. Then, too, much of this forage is produced on land unsuited for the growth of bread grains or gardens. Moreover, in addition to the land itself, labor, tools, storage, processing plants, and transportation facilities may well be limiting factors in any rapid shift to an Asiatic grain diet.

There are two sides to the question. Therefore, there must be a compromise program. As with the ship-wrecked man, there should be a sharing of the grain between human beings and livestock. A happy balance will result in the greatest total production of food. Moreover, we must not establish a short-sighted policy which will bring even greater suffering in the future. It must be remembered that a livestock breeding program cannot be turned on and off like a spigot. There will come a time, as was true after World War I, when the only outlet for surplus grains will be through channels as livestock feeds. When this time returns,

and return it will, a sound program must be at hand. The farmer's experience with expanded wheat production and eventual catastrophic prices following World War I is not pleasantly recalled. The pendulum must not swing too far.

Many farmers are also thinking of diversification with livestock as a means of conserving soil and moisture. With peak production during the war years, much of which was without regard to crop rotations, a situation encouraged by subsidized and lucrative prices for certain farm commodities, many agriculturists have now suddenly come to realize that they have lost altogether too much of their priceless top soil. Each inch of this fertility took nature 300 to 1,000 years to build. Now it is gone forever. Many of these fields have already reached a stage of abandoned buildings as marks of the past; and a stranded population to suffer the consequences. It has been said that in this comparatively young nation we have impoverished and destroyed our agricultural lands faster than any other nation or race, civilized or barbaric, in all the history of the world. Arable lands in China and other parts of the world have been devastated by this wasteful process, and the people on these skeletonized areas have endured great suffering; but these lands were used for thousands of years before they were ruined.

The stark truth is that coming events are casting their shadows before. The recent experience of Midwest motorists, driving through a dust storm with their lights turned on in the day time and scarcely being able to see the line fences along the right-of-way, is proof enough. Cash grain crops result in the marketing of soil fertility, and most often, in the loss of precious organic matter—that material which binds soil particles together, conserves moisture, and prevents wind and water erosion. On the average farm, with various classes and ages of animals, probably 80 per cent of the fertilizing value of the feed is excreted in the feces and urine—thus, with proper conservation in livestock farming this fertility value may be returned to the soil.

Certainly, there can be no doubt concerning the serious need for bread grains for Europe, and obviously, it will be necessary to bring a restricted feed and expanded livestock situation into balance. It is time for rigid culling and orderly marketing. The house must be placed in order.

There is an additional and economic reason for reducing livestock numbers, particularly cattle, at this time. We need to get numbers in balance with the long-range output. Since 1938,

we have enjoyed eight consecutive years which were generally favorable to the growth of grass in the range areas. Such a long run of good luck has occurred only once before in the past sixty years. It is vain hoping to expect that each year will continue to be a bumper crop year or a good pasture season. Cattlemen know enough about the law of averages to figure what the odds are on this sort of thing continuing. Moreover, it is important to note that cattle numbers on the farms and ranches of the country have spurted upward each year since 1938, starting at sixty-five million head and now approximating eighty-two million head. The major gain—although not all of it by any means—has been in beef cattle. Without being either a fortune teller or a pessimist, each range operator needs to very honestly ask himself the question, "Do I have a reserve supply of feed, so that there will be some grass and forage left for an emergency?" We must also recognize the fact that today there is tremendous demand for meat; and shelly, flinty-boned old cows will bring a good price. Yes, the conditions are ideal for placing the house in order, and in so doing, place the range in order from the standpoint of correct land use and soil and water conservation.

Livestock farmers and ranchers can and will rise to the occasion. It is their patriotic responsibility to bring feed and livestock into balance, to cull rigidly, and to improve the efficiency with which feeds are used. This adjustment of livestock numbers to currently available feed supplies, allowing the maximum of grain for exportation and yet retaining meat in the human diet constitutes one of the most difficult problems ever to face American agriculture. During the war, the livestock producers achieved the enormous goals set forth by the Government. With a program of subsidies and price ceilings, cheap meats were available to industrial laborers; and this was used as an effective club in holding the line on wages. The whole emphasis was on numbers and still greater numbers. Thus, with the exception of sheep and work animals, all classes of farm animals reached an all-time high. Now that the livestock numbers have exceeded the limitations of present and prospective feed supplies, readjustments are necessary in order to help the starving peoples of the world and yet avoid dangerous liquidation of livestock numbers and any accompanying serious disorganization of the livestock industry. Emphasis must be placed upon (1) rigid culling, (2) improved nutrition, (3) use of all by-product feeds, (4) maximum usage of pastures,

(5) freedom from parasites, (6) disease prevention, (7) saving of a greater percentage of new born animals, (8) avoiding bruises, (9) feeding less grain to fattening animals and marketing hogs at lighter weights, and (10) the production of more feeds. In short, the farmers and ranchers of the nation must practice these things which they already know, and a greatly expanded agricultural research program must come to the rescue. Moreover, with spiraling wages, it would seem unfair that the farmer and the packer should continue largely to assume the burden for the production of cheap meats. The present meat subsidies and ceilings are in need of overhauling. We can, and we must have both food and feed.

The Trees Can Tell You

Condensed from California Cultivator

Kenneth M. Smoyer

Assistant Farm Advisor, Los Angeles County

An orchard tool too seldom used by citrus growers is an experimental plot, or perhaps several of them, to demonstrate whether or not changes in orchard management practices could be made to advantage.

It is well known among farmers that no one management program will be satisfactory on every farm. Variations in soil, water, climate, variety, quality and age of trees, are some of the features which add complexity to the problem of efficient orchard management.

The need for a more effective management program is strongly indicated in the rapidly expanding citrus production of the United States.

There is still much to learn about how to increase production and quality of fruit and the overall efficiency of the average citrus orchard can be improved—otherwise it wouldn't be average. Improvement in efficiency does not necessarily mean reducing costs. There are many cases in which growers can spend an extra dollar and increase returns by more than a dollar. That's good business. Therefore, it is desirable that growers experiment on various phases of their orchard man-

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agement in an attempt to find what, for their conditions, is the least amount that can be spent on any particular operation or combination of operations which will produce the most fruit of the best quality.

Soil analyses and advice of so-called experts is not the final answer to improved efficiency in orchard management. These sources of information may act as guides in adjusting the program. But, no matter what information is obtained from these sources, it will still be necessary to "try it on the dog" to find out what the most efficient program might be for a particular soil and location.

Every grower would find it to his advantage to study the commonly accepted practices—more or less water, straight furrows, cross-checked furrows, and flooding—because such experiments are particularly helpful on light soils of low waterholding capacity and on the heavy soils which always retain a high percentage of moisture.

The exact quantity of nitrogen per tree necessary on a given piece of ground can only be determined by relatively long-time experiments. So it goes with all phases of orchard management.

In conducting experimental trials it is advisable to use a small block of trees in preference to making a change over the entire orchard. The plot should be carried on and watched for at least five years before being abandoned. With irrigation, for example, results of a change in practice may not become evident until two or three years after it was made.

In laying out an experimental orchard block it is best to make it conform to picking sets. Thus the grower has an opportunity of watching the picking on his experiment to determine any appreciable improvement in quality, size or production.

Blocks of at least eight or 12 trees, which are about average for the orchard, should be used. A larger number, of replicated plots over the entire orchard, is, of course, more scientific. For practical purposes, however, one experiment on a block using the average soil and the average trees of the orchard should be enough to give the grower a reliable indication of results. These plots should have one row on all four sides, known as a "guard row," to which no treatment is given other than that applied to the rows on each side of it. The guard rows will isolate the plot from other trials which may be under way in the orchard.

The most important principle to follow in conducting experimental plots is never to make more than one trial on a particular plot. For example, if the ex-

periment is method of applying water, nothing else should be done to that plot which is different from the general handling of the orchard. If it is a plot to determine the amount of nitrogen needed, be sure that the plot differs from the general orchard practice only in the amount of nitrogen used.

Orchardists will be wise to be particularly cautious in the use of new systems and new materials.

It is poor economy and poor orchard management to put many odds and ends of so-called mystic materials on orchards in the hope that some benefit might be achieved through their use. New systems and materials should, of course, be given a trial, but on a small scale until proved of value or found useless.

The above argument should not be construed to mean that every grower should divide his orchard into a maze of experimental plots. It does mean, however, that after the grower has given careful consideration to each one of his orchard practices there may be one or two open questions indicated which would justify some experimenting.

If, after watching the plots over the period of the experiment, the grower cannot observe any changes, an alteration of his orchard practice is certainly not justified. He must remember that changes in orchard management practices could prove harmful instead of beneficial. The big problem the grower has, however, is in sizing up the plots to be certain they are being observed accurately, not wishfully. To substantiate your own opinion call in neighbors and the professional field men to see if they can pick out the plots where the experiments were located. The trees will tell the story—but sometimes it takes pretty good judgment to decide what they have to say.

Cause and Treatment for Bloat

Condensed from Farm and Ranch

MANY of the old notions about bloat have fallen by the wayside in the wake of recent research. For example, bloat in sheep and cattle results from greater accumulation, not excessive production, of gases. Exploded also is the theory that alfalfa, clover, and other legumes are more inclined to generate gases within an animal than the common pasture grasses. The difference is insignificant.

Also headed for the discard is the belief that death is caused by intense pressures exerted by gases within the paunch. Instead, scientific research shows that it is practically impossible to kill animals through such pressures.

Of the five principal gases generated within the paunch, carbon monoxide and hydrogen sulfide are the two with poisonous properties. Even slightly increased quantities of either, at time of bloating, is sufficient to cause death, which probably results from distention of the paunch walls which in turn permits the gases to reach the blood stream and poison the heart, lungs, nerves, and other vital body tissues.

Some authorities have reached the conclusion that bloating occurs because the tender grasses are not sufficiently irritating to the paunch walls to stimulate belching and release of the accumulated gases. This situation can often be avoided by feeding some hay.

When turning sheep or cattle onto young clovers and alfalfa, animals should be watched. They should be allowed to graze for short periods only, then changed to natural grasses or turned into dry lot.

Providing all the hay the animals will consume for two days before turning out to pasture makes bloat less likely to occur. When grasses make up at least 50% of a grass-legume mixture, the probability of bloat is greatly reduced.

A fine, leafy growth is most likely to cause bloat, and for that reason it is advisable not to pasture a pure stand of alfalfa or clover until it has reached the bloom stage. Supplemental feeding of hay in dry lot at night reduces the incidence of bloat on legume pasture. Likewise, the feeding of hay in the pasture, after a full feed of hay overnight before the first day of pasturing serves as a bloat preventive.

Regardless of preventive meas-

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ures, some cases of bloat will occur. All too often, bloating is discovered or reported too late for successful treatment. In advanced stages immediate treatment is quite necessary to prevent the absorption of lethal quantities of poisonous gases. Having a veterinarian pierce the rumen with a sharp instrument brings relief to the afflicted animal.

Drenching is also effective sometimes with lesser bloat, provided the pressure in the rumen is not too great to permit entrance of the drenching material into the paunch. When drenching is attempted it should be under veterinary direction.

Another first aid measure is to insert something crosswise in the animal's mouth. This stimulates belching and the escape of the accumulated gases. Elevating the front feet also facilitates belching.

Creeping Trees of Siberia

DEVELOPMENT of the barren Siberian waste-land into a productive region has now been achieved by Soviet horticultural and agricultural experts, according to a Russian Relief agricultural report. This snow-covered territory, where the temperature reaches 45 degrees below zero centigrade, is now a land of thriving orchards producing increasingly beautiful crops each year.

The fruit trees planted in the region spread along the ground beneath blankets of snow instead of growing vertically. They produce more fruit per tree than the same varieties grown under normal conditions produce. Dubbed "creeping trees of Siberia," they bear fruit in their second or third year, and reach full maturity in the fourth, as contrasted with trees planted in the Moscow region which produce in their seventh or eighth year.

At a recent exhibition held in Novosibirsk, Siberia, local farmers exhibited 42 different varieties of apples, pears and cherries and 5 varieties of rowan berries. Also exhibited were locally-grown apples weighing two pounds each.

Want to Start to Farm?

Condensed from Iowa Farm Economist

THE DAY is gone when all you need to start farming is a team of horses, a plow and a wagon. Land is high in price. Modern farming requires a high investment in machinery. You need livestock to convert roughage and grain into profits. And livestock requires large investments not only for the animals themselves but also for feed, buildings, fences and other expenses. You need to buy limestone, phosphate and legume seed to maintain soil fertility. Many new methods of production call for added capital.

Adequate capital is essential to successful farming. Most farmers realize this, but many beginners underestimate its importance.

Unhappily, we have no simple "rule of thumb" for determining the exact amount of money needed for farming. Perhaps our best measure is the amount of capital actually used by successful farmers during the years just before the war. These figures indicate that an Iowa farmer who wishes to begin as an owner-operator today will ordinarily need $14,000 or more for land and $4,000 to $8,000 for personal property. This makes a total of $18,000 or more.

You don't necessarily need to have all this cash in your pocket to start farming. You can borrow. The usual sources of real estate credit are: Relatives or other individuals, banks, life insurance companies, federal land banks and the Farm Security Administration. Some sources of credit on personal property are: Relatives and other individuals, banks, merchants, production credit associations, the Farm Security Administration and emergency crop and seed loans.

The proportion of the total that may be safely borrowed is definitely limited. A farmer's earnings vary widely from year to year. You will want to keep your loan within the limits of your earnings in the *unfavorable* years.

Past experience indicates that you should exercise special caution in borrowing money to buy real estate or personal property at the current high price level—even though prices of farm products now seem to justify such a loan. Let's not forget that you ordinarily need 20 to 30 years to repay a real estate loan. During this time, prices of farm products (and your profits) may drop enough to make repayment of

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such a loan difficult or even impossible.

Few farmers starting with a 100 percent debt have succeeded in paying out. Those who have as a rule did so because they either: made a fortunate purchase; were favored with unusually good crops and weather conditions or prices; had far more than average ability; or sacrificed family living.

If we have learned any lesson from the experiences of the last 20 years it is the importance of having a farm of adequate size and sufficient productivity for the type of farming in which the operator engages. So, try to select an area where farmers are generally successful. Do not overestimate your ability to succeed where others have failed.

For the man with limited capital, it's a much better idea to rent a good farm than to buy land where the soil is poor. A farm low in productivity may seem like a bargain to you. But beware! You are likely to find such a farm a bad bargain. Usually farmers have found it harder to pay for poor land than for the more productive farms. You may hope to increase the productivity. Occasionally this is possible. But usually you will spend years of effort and end up a disappointed old man. Poor land is a good buy only if it is in line with its net earning ability.

There are many methods of renting. The one best suited to your needs will depend upon your farm experience and capital available. All leases provide for the landlord to furnish the real estate capital. Usually the tenant must have the cash for his immediate operating and living expenses.

Under the one-third, two-thirds crop and share lease, the landlord usually owns all of the personal property except a third of the feed and seed and the tenant's automobile. The tenant receives one-third of the income. He furnishes all of the labor and pays one-third of certain expenses as may be agreed upon. This is a good lease for a young man short of capital.

The 50-50 stock share lease is growing more popular each year. Under this lease the tenant normally furnishes the machinery, power, labor and half of the feed and livestock. The farm income is usually divided equally. A tenant who uses this lease has greater freedom in his livestock program.

Tenants who have still more capital may prefer the crop share lease. It differs from the stock share lease in that the tenant owns all the livestock and feed. He usually pays cash rent for pasture and buildings. This lease gives the tenant greater freedom

in the management of his livestock.

Some tenants prefer the cash lease because it gives them the most independence of any method of renting. The tenant owns all the livestock, equipment and feed, and pays cash rental for the farm. This lease requires more money to swing than other types. The tenant assumes a greater risk —but if he does well he benefits accordingly. With falling prices, however, the cash renter pays more than under a crop share lease.

A young man with a minimum of experience and money will find a father-son agreement one of the better ways of getting started in farming—provided he and his father can work together. These father-son plans give a boy the chance to learn the recent developments in farming and to benefit from his father's experience. Also, a young man needs less capital to get started this way than by any other method.

The idea of working as a hired man may not appeal to many people. But it is a way to save up money while you gain experience and become established in a community. It may be much cheaper to gain experience working for an outstanding farmer than to experiment on your own farm. Then, too, wages paid to hired men are higher than for years.

A man starting to farm may wish to get himself established in a community on his own farm but lack sufficient funds to buy a farm large enough to use his machinery effectively and to provide a satisfactory living for his family. Often he can buy a small farm and then rent additional land to build up business. Then, as he gets more funds he may buy nearby land.

One of the objections to starting in this way, especially in areas where livestock are important, is that nearby land may not be available to purchase when it is needed. Scattered pieces of land may increase the labor needed and make it hard to use pasture effectively.

Your best bet to follow in getting into farming depends upon your qualifications and the opportunities available. Before you start farming you should size up your own qualifications. Then do your best to get located where you will have an opportunity to get training, experience and capital for final ownership of livestock, equipment and a farm. A modest start as a hired man or a tenant may put you farther ahead in the long run than if you attempt a too ambitious program at the beginning.

Editor's Note: This article is condensed from the North Central Regional Publication, "Capital Needed to Farm in the Midwest."

Feeds Necessary to Make Eggs Hatch

Condensed from The Farmer's Advocate

Dr. R. M. Bethke

Ohio Agricultural Experiment Station

PROPER nutrition or feeding has been shown to be an all-important factor in poultry production. The more information we accumulate on poultry nutrition the more we are impressed with the fact that the nutritive requirements for good hatchability are greater and more exacting than for egg production, and that good nutrition of the breeding flock is a factor in the performance of the chicks hatched from such a flock, especially during the early stages of growth. In other words, good egg production is no guarantee that the eggs will hatch well and produce good vigorous chicks.

Hatchability depends upon the "nutritional status" of the eggs which are being incubated or upon the presence in the egg of those essential nutritive factors that are required for the proper growth of the embryo. If any of the essential factors are absent or lacking in the egg at the time it is laid, the embryo will die prematurely, just as the hatched chick will die if not all the essential nutrients are supplied.

Good hatchability, as a rule, is not a problem when the breeders are out-of-doors and have access to green grass and sunshine. However, when the birds are confined indoors and deprived of green feed and direct sunshine, a large percentage of the eggs frequently fail to hatch unless green feed and sunshine substitutes are included in their ration. Feeding for hatchability and good early chick performance, in the main, is a recognition of the importance or essential nature of certain vitamins, minerals, and protein supplements in the ration.

Experimental work has shown that an insufficient intake of vitamin A may adversely affect hatchability and particularly the vigour and vitality of the chicks hatched. Although the effects of a vitamin A deficiency on hatchability are not so marked as those of some other vitamins, it nevertheless is a factor that must be reckoned with. Breeder rations

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should contain not less than 3,300 units of vitamin A per pound of total feed to insure good hatchability and to produce chicks with proper vitamin A reserves.

Vitamin D, or the sunshine factor, is of singular importance in hatchability. Experimental work, without exception, has shown that when layers do not have access to direct sunshine or the amount of sunshine is inadequate, hatchability will be lowered unless vitamin D in some form is supplied. Many reliable and effective chick tested vitamin D products are available which when used at the rate of 450 A.O.A.C. chick units per pound of total feed will supply adequate amounts of this vitamin. It is well to remember that the vitamin D needs for optimum hatchability are somewhat higher than for egg production and several times greater than for growth.

Vitamin E, frequently referred to as the antisterility vitamin, has been shown to be required by poultry. Experimental work within the past several years has revealed that the addition of wheat germ oil as a source of vitamin E to a good ration containing ground whole grains, cereal by-products, alfalfa meal, protein supplements, minerals, and other essential vitamins did not increase the total number of chicks hatched from a given number of eggs. From this work as well as other observations, it appears that a ration containing good quality whole or ground grains, cereal by-products, alfalfa meal, protein supplements, essential minerals and other vitamins will supply adequate amounts of vitamin E to meet the needs for good fertility and hatchability.

Experience taught us that the feeding of milk products and green feed to breeders improved the hatchability of the eggs and the quality of the chicks that hatched. In other words, there appeared to be "something" in milk products and green feed which was favourable to the production of eggs that hatched well and chicks with vigour and vitality. Science in the past decade has shown that part of the "something" in the milk products and green feed which proved beneficial was riboflavin. The effects of riboflavin on hatchability are rather dramatic in that the hatchability of eggs can be increased or decreased by 75 per cent in the course of two or three weeks. For example, birds on a ration deficient in riboflavin may produce eggs very few of which will hatch, and the addition of adequate amounts of natural or synthetic riboflavin may increase the hatchability to 80 per cent in the course of two or three weeks. The needs for riboflavin are greater for good hatchability than for egg production. A level of 1.3 mili-

grams of riboflavin per pound of total feed should prove adequate for good hatchability and a good quality chick, whereas around 0.9 milligrams per pound of total feed is reported to be adequate for egg production.

In recent years it has also been shown that other factors of the vitamin B complex in addition to riboflavin are involved in hatchability. Amongst these factors are pantothenic acid and pyridoxine (vitamin B_6). From the available information on the distribution of these factors in feedstuffs and their requirement by poultry, it is my judgment that the average poultry ration made from the more common feedstuffs will not be found deficient in these two vitamins.

Another factor concerned in hatchability is a substance (or substances) present in certain animal products. The nature of this substance is not known. Nevertheless, it is apparent from the reports of several investigators as well as our own experience that animal products such as dried milk, meat scraps, fish meal, liver meal, etc., contain a substance (or substances) which is partially lacking in a presumably complete all-plant ration in which soybean meal serves as the chief source of supplemental protein. For example, in an experiment at our institution involving duplicate pens of birds, only 70 per cent of the fertile eggs produced on the soybean oil meal ration hatched in comparison to 88 and 89 per cent hatchability when the soybean oil meal was replaced by an equivalent amount of meat scraps and menhaden fish meal protein. The inclusion of 5 per cent of dried skim-milk in the meat scraps or fish meal ration did not improve hatchability, whereas in case of the soybean oil meal ration the mink accounted for a 14 per cent increase in hatchability. Further work has shown that the inclusion of 5 per cent meat scraps or fish meal in an all-mash soybean oil meal ration containing fermentation solubles as a source of riboflavin and other vitamin B complex factors was more effective than an equal amount of dried skim-milk in maintaining good hatchability. The use of more than 5 per cent meat scraps or fish meal in the soybean ration did not show any further increase in hatchability.

It has long been recognized that the minerals, calcium, and phosphorus are important in egg production and in hatchability. A good breeder ration or a sound feeding programme should make certain that these two mineral elements are not lacking. During the past few years it has also been shown that a deficiency of manganese in the ration will affect hatchability adversely and make the chicks produced more sus-

ceptible to perosis. Although the common poultry feedstuffs contain some manganese, it is good insurance to include some effective manganese mineral in the breeder mash.

Science and practical experience have established that proper nutrition of the breeding flock is reflected in the performance of the chicks during the early stages of growth as well as in hatchability. Chicks hatched from eggs which contain only enough of the vitamins to meet the needs of the growing embryo up to the time of hatching will not carry a vitamin reserve and must depend entirely upon the adequacy of the man-made ration supplied them. On the other hand, if the breeders are fed so that they can produce eggs which are rich in vitamins, then the chicks hatched from such eggs will carry a "vitamin reserve account" on which they can draw if necessary. Inasmuch as the chick cannot add any nutrients to the egg from which it is hatched, it is obvious that it is the responsibility of the feeder to make certain that the breeders are supplied with all the necessary nutritive essentials so that they can produce eggs which contain all the nutrients essential for good hatchability and the production of "reserve account" chicks.

Soil Deficiencies and Disease

Condensed from New England Homestead

THE true cause of many livestock diseases may now be traced directly to the soil of fields or pastures, according to a recent report by the American Veterinary Medical Association.

Nutritionists and veterinarians are gathering more and more evidence which indicates that the presence or absence of so-called "trace elements" may mean the difference between health and disease in many farm animals. It is only in the last decade that biochemists have perfected intricate tests for measuring and evaluating these trace elements in their relationship to animal welfare.

Some of these trace element deficiencies, as cited in the report, include the following instances:

In New Hampshire, in Old Ontario, in the Grand Traverse section of Michigan, and along the Florida-Carolina coast, cattle on many farms slowly lose weight and condition. Their blood be-

Reprinted by permission from the New England Homestead, Springfield, Mass., May 11, 1946

comes thin, their fertility is below par, and they gradually waste away and die—even though in the midst of good pastures. Some of the most severely affected animals even chew bones or constantly lick wooden fences.

The cause of this wasting sickness has been found to be a deficiency of the earthy element called "cobalt." As little of it each day as will rest on the tip of a knife blade, when supplied to the ailing cows, soon brings them back to a state of good health. When pastures are top dressed with superphosphate containing less than a tin-cupful per ton, the wasting sickness is completely eliminated.

A farmer in Michigan bred his best Holstein cow to a prize bull. Instead of a sturdy, healthy, living calf, the cow gave birth to an almost hairless dead baby, its neck swollen and distorted by a grossly enlarged thyroid gland. If the cow had received enough iodine each day to equal the weight of a pea, the accident would never have happened. In the northern states, from the western boundaries of New York to Montana, a natural deficiency of iodine in the soil and water may cause prenatal goiter and stillbirth in all species of animals, as well as poor hatchability of eggs.

In a western state a rancher noticed that lambs and young ewes had a peculiar gait when moved. As they walked, the hindquarters would swing or sway and, often, the lamb would make a sharp turn and fall on its side. The wool crop from the flock was "stringy" and of poor quality. This is the disease that the Australians and Britishers call "sway-back." It is due to an absence of copper in the soils of given regions. When as little as two tablespoonfuls of a copper salt are mixed with each hundred pounds of salt lick, the "sway-back" trouble disappears.

These are only a few of the many odd and serious animal maladies which may hamper livestock production. Deficiencies of manganese, of zinc, or phosphorus and calcium may also be responsible for mysterious losses among flocks and herds which are apparently given good care and feeding.

Careful checking is often necessary to discover the true cause of such maladies, and veterinary research workers report that they are making more and more progress in this field all the time.

Eventually it is hoped that county and district soil surveys will also provide accurate data which will aid prevention of many of these costly and obscure trace element deficiencies in livestock feeding.

Tending Lights and Starter

Condensed from Missouri Ruralist

William H. Crouse

WHEN farmers buy new farm tractors, they quite often specify electrical equipment. It is generally recognized that the storage battery, lights, generator and electrical cranking motor or self-starter add considerably to the usefulness and economical operation of the tractor.

A charged battery can supply current for lights or for cranking the engine; a discharged battery cannot. The generator on the tractor normally keeps the battery charged. The entire action is automatic. Cranking the engine or using the lights when the engine is not running discharges the battery; the generator recharges the battery while the engine is running.

About the only service the battery requires is occasional addition of water to each of the 3 cells. The vent plugs must be removed in order to add the water. While distilled water is best, any water fit for drinking, and without excessive mineral content, can be used. The frequency with which water should be added is determined by the type of service and temperature. For example, long hours in a hot field cause the battery to lose water rapidly. Unless this water is replaced frequently, the internal parts (including the battery plates) will become exposed to air so they will dry out and battery life will be greatly shortened. On the average, a tractor battery should be watered every 120 hours of operation.

Do not add too much water, since overfilling will cause the battery liquid to bubble out and get over the battery and adjacent tractor parts. This liquid contains sulphuric acid which is very corrosive. In case you get any of it on your hands or clothes, or on the tractor, it can be neutralized with baking soda and then washed off with plenty of water.

Never try to recharge a battery by putting chemicals in it. Adding any chemical "dope" to the battery may ruin it and will not have any effect on its state of charge. The only way to recharge a battery is with the generator on the tractor, or with the battery charger such as used in service stations.

Incidentally, if you have to operate a tractor without a battery, be sure to disconnect the lead from the terminal of the generator. This keeps the generator from producing any output which would cause it to burn up without the battery connected.

The top of the battery should

Reprinted by the Missouri Ruralist, May 11, 1946

be kept clean and the cable clamps kept tight on the battery terminals. An easy way to clean the battery top is to tighten vent plugs, sprinkle baking soda on the battery top, wait until the foaming stops and then flush off with plenty of clean water.

The generator is driven by the engine, and produces electrical current which not only lights the lights when they are turned on but also recharges the battery, as already explained.

Many tractors have a light switch with a generator control in it. This switch has three positions: "off," "on," and an intermediate "high output" position. In the "off" position, the lights are out and the generator output is cut down to a small current. In the "on" position, the lights are on and the generator output is high enough to take care of the lights and still provide a charge to the battery. In the intermediate "high output" position, the lights are off but the high output is still obtained from the generator. This intermediate position should be used only when the battery is in a discharged condition. If it is used when the battery is charged, the battery will become overcharged and will be severely damaged. You can tell when a battery is fairly well discharged because it won't crank the engine very fast, as it does when it is fully charged.

Every time the engine oil is changed, add a few drops of light engine oil to each generator hinge cap oiler. Avoid excessive oiling since this would cause oil to get on the generator brushes and commutator where it would form gum and prevent the generator from working. Generator brushes are originally three fourths of an inch long. When they are worn down to one half this length, they should be replaced. A dirty or rough commutator calls for servicing at your tractor dealer or electrical service station. Inspect the generator drive belt occasionally to make sure it has enough tension and that it is not excessively worn or frayed.

The cranking motor is very similar to any other electric motor around the farm and requires similar care. This care includes lubricating the motor occasionally with a few drops of light engine oil, and a check of the motor brushes about once a year.

The brushes are easily inspected by removing the cover band on the cranking motor. New brushes are five eighths of an inch long. If the brushes are worn to about one half this length, they should be replaced. Also, if the commutator on which the brushes rest is very rough or dirty, the motor should be taken to your nearest service station for repair.

Mastitis Program

Condensed from Southern Agriculturist

A. A. McMurray

Soon after the beginning of our mastitis program for Tennessee's dairy industry—in March, 1945—two definite conclusions were reached:

1. That mastitis was Problem Number 1 in our dairy herds.

2. That milk producers and dealers would support a constructive plan for the control and prevention of this infection.

A total of 1,148 cows was examined in Tennessee, and 620 of the cows (54 per cent) showed some degree of mastitis in one or more quarters of the udder.

It is reliably estimated that about one-fifth of our dairy profits is lost because of mastitis. Now, dairying in Tennessee is an $87,000,000 industry—after the one-fifth has been lost. This means that about $17,000,000 is lost to the state each year because of mastitis.

To carry out mastitis research, we selected 15 dairy herds scattered over Tennessee, and with the very fine co-operation of each owner or herdsman, set up specific procedures and kept close and constant observation of the cows.

In all the herds that we examined, we found mastitis present—not because of any lack of desire to control it, but because of a lack of knowledge on the part of the owner on how to cope with the disease.

We found, after co-ordination of all our observations on the 15 herds, that the solution to the mastitis problem is good herd management and correct milking practices.

Mastitis, we are now confident, can be eliminated, controlled and prevented through the efforts of a well-qualified herdsman. (A herdsman, it should be mentioned, can be either owner or employee; his duties in the care of the herd start with the calf and continue through the milking life of the cow.)

There is no one, easy way to end mastitis in dairy production. On the contrary, there are many rules a herdsman must follow, and we list them here in order of their importance:

1. Stop calf and heifer sucking. Often first calf heifers come fresh with mastitic quarters caused by this kind of injury to the developing mammary glands.

Reprinted from the Southern Agriculturist, Nashville, Tennessee, May, 1944

2. Observe sanitation. Mastitic organisms lie in and about the barn, in mud and stagnant pools, ready to infect an injured udder.

3. Dry-off cows properly. Do this at the end of the lactation period. Dry the cows off at least six, preferably eight, weeks before she freshens. Do it by milking her out thoroughly, taking away all dairy feeds except hay, giving her a limited supply of water for about three days, milking her out, continuing the hay diet (no pasture) for a few days, and then turning her with the other dry cows. Sometimes, in the case of an infected udder, more milking may be necessary.

4. Give cows a properly balanced diet. This assures a uniform milk flow. Sudden changes of feed, especially of a high protein content, will stimulate the activity of secreting glands and cause an irritation in some cases.

5. Have your herd examined and graded. After the mastitis test, all infected cows should be arranged in the stable so that they are milked last. The strip cup technique should be learned. The cows should be examined often to check on new mastitic cases. When the herd has been put in good health status, it should be examined two or three times a year by skilled technicians and two or three times a week by the herdsman.

6. Know all types of injuries so you may prevent them. (Injuries always precede mastitis.)

Three types of injury are mechanical, thermal, and chemical. Under the mechanical type are cuts, scratches and abrasions on the teats; bruises on the udder from kicks, from being stepped on, chased in the pasture, calf sucking, stepping over high obstacles and being horned by other cows; injuries from bites, stings, rough hand-milking, and prolonged use of the milking machine after the udder is empty.

Under the thermal, or temperature type of injury, can be listed the following practices: lying on cold damp floors, sudden exposure to cold drafts, turning cows out in the cold with wet udders, hosing udders with cold water, and exposure to cold rains.

Chemical injuries result when filth, such as urine and manure, comes in contact with the teats.

Poor milking practices, however, cause the greatest number of mastitic cases. We suggest the following milking procedure:

1. Sterilize the hands and teat cups after milking each cow.

2. In hand milking, use precaution to prevent injury—don't strip by the thumb-and-finger method.

3. Use vacuum in operating milking machines. Remove teat cups immediately after udder is emptied.

4. Provide an individual cloth

for the proper cleaning of each udder before milking.

The herdsman can not possibly keep his cows free from occasional injuries to the teats and udder, but preventive treatment can accomplish a great deal.

Minor cuts, scratches and abrasions should be thoroughly cleansed, before and after each milking, with cotton saturated in alcohol. Then the cow should be put on clean bedding—and, if infection is started, placed to herself, concentrated feeds reduced, and milking done every one or two hours until the infection is relieved.

Medication, or udder infusion, should be done by a veterinarian. The few cows we have treated by intramammary administration have responded favorably to penicillin. Less favorable results were obtained with silver nitrate, sulfanilamide in oil, and other mixtures.

In summing up the results obtained on these demonstrational herds, we wish to direct your attention to the fact that results on each dairy farm were in the same proportion as good herdsmanship was practiced. This report has emphasized the herdsman's importance, but we do not wish to suggest that the herdsman is able to perform all the detail duties involved in the management of a herd. A good herdsman knows his limitations, and will call in skilled assistance when this kind of help is necessary. This is what was done over and over again on these Tennessee dairy farms co-operating with us in our program to prevent mastitis.

Methods of Hog Raising Changing

Condensed from The Farmers Guide

J. P. Hoekzema

FARMERS are interested in the latest information in producing pork. This was evidenced when more than a thousand farmers met recently at the Purdue experimental hog farm to see and to hear what developments were made during the past year.

One experiment should be seen to be believed. These were the lots to determine whether or not hogs need salt. The answer was very evident, as the lot receiving no salt weighed only 174 pounds on the average and the salt fed pigs averaged over 250 pounds each. Interestingly enough the pigs each consumed only about a pound of salt during the feeding trial but there was a difference in weight of over 75 pounds per pig. The feed saved by one pound of salt was worth $6.37. This was due to a saving of 214 pounds corn, 46 pounds protein supplement, and 27 pounds minerals. In addition to this the salt-fed pigs gained almost twice as fast as the pigs without salt. Possibly one reason for slow gaining pigs (in certain cases) is the lack of salt in the ration.

In this experiment 4 lots of pigs each weighing about 90 pounds were selected. Fourteen pigs were in each lot. The pigs were placed on experiment on June 14. They received shell corn, a protein mixture of 90 percent soybean meal and 10 percent alfalfa leaf meal. This mixture was used instead of one that contained animal protein as they wanted a ration deficient or lacking salt. The mineral mixture in Lot 1 was equal parts of steamed bone meal and pulverized limestone.

The pigs in Lot 1 that had no salt knew that there was something missing and consumed 17 pounds of mineral for each 100 pounds gain they made. This corresponded with about a pound of mineral where salt was fed. Even though these pigs had all the grain and supplement and mineral that they wanted—and weighed 90 pounds each, they gained less than a pound per day for the 85 days they were on feed. The cost of the feed in order to make 100 pounds gain was $12.53. This does not include original cost, labor, overhead, or any other of the costs that enter into pork production.

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The Lot 2 were fed exactly alike except that in the mineral feeder the mixture was placed on one side and loose salt was placed on the other side. These pigs gained almost two pounds per day (1.94) at a feed cost of $8.68 per 100 pounds of pork. The feed cost was reduced by 50 percent and the rate of gains were doubled. The 14 pigs ate 14 pounds of salt during the 85 days.

Lot 3 were fed the 10-10-1 mineral mixture. This means 10 parts steamed feeding bone meal, 10 parts pulverized limestone and one part salt. In addition they were given all the loose salt they wanted and the results were very similar to those of Lot 2.

Lot 4 had the loose salt in the mineral mixture and instead of loose salt before the pigs at all times they had block salt. Again the results were very similar to those of Lot 2 and Lot 3. When block salt was provided less salt was consumed than when loose salt was provided. The pigs ate about the same amount (total) as they consumed more mineral that contained 5 percent salt.

From these experiments it appears that pigs need salt and that there is a difference in the amounts that different pigs need. Some humans eat more salt than others. It looks as though pigs vary in their requirements but it is safe to say that all pigs need some salt. It also appears that the 10-10-1 mixture does not contain sufficient salt—especially when little or no animal protein is provided. Two methods may be used. Either use a 10-10-2 mixture or use the 10-10-1 mixture and allow the pigs free access to salt in addition. The latter method will make allowance for the individuals that like more salt in their ration.

There are one or two things that should be kept in mind in feeding salt. If pigs have had no salt and were given all they wanted at once they might eat too much and die of "salt poisoning." Get them used to salt gradually or let them have all the mineral mixture containing some salt that they want. When loose salt is fed care must be taken that the salt is covered and kept dry. If water gets into the salt box and a brine results the pigs might drink the brine and die of "salt poisoning."

The experiment that was started a year ago to determine how the protein might be limited to pigs on good pasture was again repeated. Results were similar this year to those obtained last year. The results indicated that hogs should have an adequate supply of protein and other feeds until they are well started and weigh at least 75 pounds. Limiting protein should be done only when good pasture is available. A mineral mixture must be fed.

All pigs in these lots were fed the 70-20-10 mixture until they weighed 75 pounds each on the average. Fourteen pigs were placed in each lot. In each lot they were fed all the corn and minerals they wanted. The 35 percent protein was self-fed in addition to certain lots. Lot 1 had none and gained the slowest and had a number of unfinished pigs in the lot. If one wants to hit an early market this method would not be recommended. The cost of producing the pork was not much different from those in the other lots. The cheapest gains this year were made in Lot 2. These pigs were given the protein supplement until they weighed 100 pounds each and then it was discontinued. They gained 1.84 pounds per day and had a feed cost of $7.08 per hundredweight. Other lots were fed protein until they weighed 125, 150, 175, and 200 pounds. Generally speaking the longer the protein was fed the higher the feed cost per 100 pounds of gain, but the better finished the pigs were. It was also brought out that pigs gained faster this year than last year as the weather was cooler and the pasture was better. Pasture certainly saved a great deal of feed and in most of the lots there was no rooting even though the pigs were not rung. The lots that had the least protein had rooted the most.

Feeding Supplements

Supplement C has been recommended for summer feeding and Supplement 5 for winter feeding. It was thought advisable to see whether one of these could be used the year around so a comparison was made. Supplement 5 produced almost as fast gains and the gains were at slightly lower cost than the pigs receiving Supplement C. They tried to change the supplement by taking out some of the fish meal and replacing it with meat scraps. There was little difference in the rate of gain and a little increase in the cost of gain with the lot receiving the smaller percentage of fish meal. Supplement 5 made up of 20 parts meat and bone scraps, 20 parts fish meal, 40 parts soybean oil meal, 10 parts cottonseed meal, and 10 parts alfalfa leaf meal can be recommended as an all year round supplement.

Self-Feeder Helps

Still another change is the use of the self-feeder. This has come about more slowly but is gaining ground continuously. Mr. Schwab recommended that pigs be self-fed from the time they were two weeks of age. This can be done by using creeps or if one wishes he can also self-feed the sows.

The use of more and better pastures is also an important step in the production of good thrifty pigs. An acre of good alfalfa should provide pasture for about

20 pigs. Some farmers use the first cutting for hay and the second cutting for pasture. An acre of good pasture will save 15 to 20 bushels of corn and 500 pounds of protein supplement.

Vaccine to Save Water Buffalo in China

A GIFT from the Canadian and American governments to UNRRA of one million doses of a new type vaccine to prevent death dealing rinderpest among surviving cattle and water buffalo herds of China, was announced recently by Director General F. H. LaGuardia, who also stated that the vaccine is being flown from Montreal to Shanghai so that it can be put to use in the shortest possible time.

Emphasizing the significance of the gift, Mr. LaGuardia said, "Every water buffalo or bullock saved for the plough means that we save the life of several hundred people. In a land where the war against starvation is decidedly on the defensive I regard this timely donation of rinderpest vaccine as I would the finding of a fresh cache of ammunition. Rinderpest kills animals in a matter of days and hours. It is on the rise now in several productive sections of China where work animals are already too few.

The vaccine cargo left Dorval Airport, Montreal, Wednesday, May 1, for Newark, New Jersey. After being re-dry-iced in New York City it was transhipped to San Francisco. There it will be loaded aboard a C-54 plane carrying to China an all UNRRA cargo of smallpox and cholera vaccines and other urgently needed perishable medical and veterinary supplies. Weather permitting, the plane is expected to take off for its Pacific flight May 7, landing in Shanghai May 10th or 11th.

The rinderpest vaccine was developed in an experimental laboratory on Grosse Isle in the St. Lawrence River during the war, as a joint project of the Canadian and American governments. A stock pile was then accumulated to place at the disposal of the U. S. Pacific forces, if an invasion of the Asiatic continent had become necessary.

Rinderpest, a digestive tract disease attacking cattle, goats, and other cloven hoofed animals, is nearly always fatal. It is spread by means of contact, such as using the same feed trough or water hole, and often kills all susceptible animals within range of its attack. The present outbreak in Asia has been described as "spotty."

The new vaccine is said to be many times as effective as any previous method of control.

The Horseshoe for Luck

Condensed from The Cattleman

A. M. Hartung

OF ALL THE emblems for good fortune, the horseshoe stands among the first. Almost everyone considers it unlucky to pass a horseshoe on the road without picking it up. If the ends point away, the sign is that good fortune will be within grasp, but by extravagance, carelessness, or the operation of rogues, it may depart almost as soon as it comes. The proper thing to do is to turn the horseshoe around so that the ends are toward the finder before picking it up. While carrying it home it is correct to hold it with the ends upward or the earth will attract to itself all the promised fortune.

When the shoe is nailed over a door or window, the ends must be upward, or the good fortune will be nullified. Instead of keeping the evil spirits away, the shoe placed in wrong position will attract them. Instead of bringing good fortune, the luck of the house will be diverted. It is supposed that the element of electricity enters into the charm. With the ends upward beneficient rays will spread over the house as a protecting influence, but with the ends downward, the good rays are thrown into the all-receiving earth, and with them many of the good influences that are about the place.

A century ago it was a common sight to see upon a cow shed door a horseshoe that scared off witches who milked the cows or dried them up. If precautions were not taken these mischievous witches would ride the horses at dead of night over the hills, and when the owner came to the stable in the morning he would find his animals in a lather and utterly exhausted. A horseshoe fastened over the door of the stable was believed to ward off such evil.

The horseshoe is a sign emblematic of the greatest power. We are indebted for this statement to tales centuries old, that have descended from father to son and from mother to daughter, through the years. It is not difficult to understand why lovers of horses came to adopt the horseshoe as a talisman against misfortune, for among the superstitions of the past horses were considered to be especially liable to the machinations of witches. This stands out in all the records of

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the Lancashire witches and other evil hags.

There is no superstition more deeply ingrained in all classes of society than that which is attached to the horseshoe. As an emblem of good fortune it holds pride of place. Nelson did not disdain to nail a horseshoe to the mast of his ship to help assure victory. In the early part of the 19th century, the horseshoe was highly prized and there were few American and English mansions where it was not displayed. Humbler folk went to great pains to fasten it over their doors. The luck of the horseshoe had a respectable beginning. It is traced to the old Greeks and their sea god Poseidon, who was identical with the Roman sea god, Neptune.

The Poseidon horses were sacred and to him were sacrificed. Poseidon was believed to have created the first horse when he struck the ground with his trident and a horse sprang from the hole, which afterward became a spring. To him all springs were ascribed. In the shape of a horse he sometimes wandered by the shores of his ocean domain and where he struck his hoofs deeply, waters gushed out and permanent springs were formed. This is the reason why horseshoes are considered lucky. Going to the root of the supersitition, one sees a nature myth as the underlying principle—from the sea all rain comes and to the sea all springs owe their primal origin; and to the rain and fresh waters, sea derived, we owe all fertility on earth. The old Greeks, therefore, worshipped Poseidon as the fortune giver through his springs. They gave him horses and they adored the footprints of horses when they found them, for they might be the very footprints of the god himself.

Horses were not shod by the Greeks or Romans, the ancients being content with wrapping fibre cloth around the feet of their horses. Nero, who ever tried to out-distance his contemporaries, caused his horses to be shod with silver shoes, but in no case were nails driven into the hoofs. The practice of shoeing horses by driving nails into the hoofs was introduced into England by William, the Conqueror; but the practice did not make any headway for centuries.

American Indians, who had no superior as horsemen, never thought of shoeing their horses in any way, yet they were able and capable of performing remarkable journeys over most difficult country. In Asia today modern horseshoes find a strong competitor in the old-fashioned straw sandals which are fastened to the hoofs after the manner of equine cricket shoes.

On the gate of Oakham castle,

an ancient Norman mansion in Rutlandshire, were formerly seen a number of horseshoes of different patterns. It was said that every nobleman who journeyed through the town was obliged, as an act of homage, to forfeit a shoe of the horse whereon he rode. The horseshoes thus obtained were nailed upon the gate, but are now within the walls of the castle. Queen Elizabeth is thought to have initiated this practice. According to tradition, she was once journeying on a visit to her lord high treasurer, Wm. Cecil, at his residence near Stamford. While passing through Oakham her horse cast a shoe. In memory of the mishap the Queen ordered a large iron shoe to be made and hung up on the castle, and that every nobleman traveling through the town should follow her example.

While John of Gant, son of Edward III of England, was riding through the town of Lancaster his horse cast a shoe, which was kept as a souvenir by the townspeople and fastened in the middle of the street. In accordance with time-honored custom a new shoe is placed in the same spot every seven years by the residents. Aubrey, in his Remains of Gentilisme, describes the horseshoe as a preservative against the mischief or power of witches, attributing its magical properties to the astrological principle of Mars —the god of war. The war-horse was an enemy of Saturn, who, according to a medieval idea, was a liege lord of witches. The supernatural qualities of the horseshoe as a preservative against imaginary demons have been supposed to be due to its fabricated shape, as any object having two prongs or forks was formerly thought to be effective for the purpose. As with the crescent, the source of this belief is doubtless the appearance of the moon in certain of its phases.

When horses came to be shod with iron shoes, the transition of the luck emblem from the footprint to the shoe-mark — practically the same thing—was easy. Pegasus, the winged horse, from whose hoofs the water springs gushed copiously when he came to earth, has been credited with "horseshoe luck." Some legends called him the son of Poseidon, and, therefore gifted by his father with power to call the waters from the earth. From these springs the Muses drank freely.

New Way To Market Meat

Condensed from Capper's Farmer

Sleeter Bull
University of Illinois

AN ENORMOUS increase in the sale of pre-cut, pre-wrapped, fresh meats during the next few years is expected by the meat trade. A skilled butcher will cut meat, not sell it, and a salesperson will package it in transparent material, label it and sell it.

Here are some reasons why the trend is in this direction:

A skilled meatcutter draws $50 a week and up, depending upon the locality. He may or may not be a good salesman. His apron may or may not be bloody. His fingernails may or may not be clean.

An attractive salesgirl costs half as much as a butcher. She can dispense meat from the case as well as or better than he can.

The butcher can spend his time more profitably in the cutting room preparing the cuts which the skillful girl can package in cellophane, pliofilm or other transparent wrappers and label with the name of the cut, weight, grade, price and total cost. She may even insert cooking directions for the benefit of the inexperienced housewife. Or, the customer may reach into the refrigerated case and carry her meat to the cashier just as she does a box of oatmeal. A girl can replenish and keep the stock in order.

This is not an entirely new idea. Several chain stores in the East have sold pre-cut packaged fresh meats for many years. Another chain is trying out the idea in its "guinea pig" store in Cincinnati, Ohio, where it experiments with innovations in the distribution of foods. The meat is cut by expert butchers, packaged in a transparent wrapper by girls, each cut is labeled with its name, grade and price, and the housewife selects whatever she desires from a refrigerated, self-serve showcase. I am informed that the public has accepted the idea and that the meat department of this store shows a larger profit than those in stores where meat is sold by the conventional method, because of lower labor costs.

Many food stores do not have enough meat volume to justify

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the employment of a butcher. It certainly would be a distinct advantage to such markets if they could purchase pre-cut pre-wrapped cuts from the packer. So far as I know, no packer yet offers this service.

The principal objection to the marketing of pre-cut fresh meats is the loss of "bloom" and the deterioration in color of cuts which are not sold soon after cutting. A sirloin steak which lays in the showcase for several days darkens and eventually goes into hamburger at a big financial loss to the retailer.

The sale of pre-cut, pre-wrapped frozen retail cuts would solve this and many other problems of the retailer and consumer but would introduce others. This idea is not entirely new.

Birdseye marketed some frozen meat for several years prior to the war. Its acceptance by the trade was not particularly successful, probably due to the fact that housewives were not familiar with frozen foods. Certainly most housewives now accept frozen foods and many prefer them.

Years ago, Swift and Company sold pre-packaged frozen meats in a small way, and the customers liked them after they had become accustomed to them.

Many packers are mulling over the idea and a few are doing research work on methods of cutting, freezing and packaging meat for the retail trade. Some locker operators, and we now have 6,464 in the United States, are also considering the processing and sale of frozen meat cuts at both wholesale and retail.

If pre-cut, frozen meat is put on the market, the bones and surplus fat should be removed for 2 reasons: (1) Boneless cuts can be packaged to better advantage for freezing than the regular cuts containing the bones. For freezing, cuts must be wrapped in a moisture, vapor-proof wrapper with as little air in the package as possible. It is impossible to wrap a standing rib roast so as to remove all the air from the package. With a boneless roast, it is easy to do. (2) It is uneconomical and wasteful to ship bones and surplus fat around the country.

Not all of a carcass is edible meat. We do not eat the bones and most of us trim off a part of the fat, especially from high-grade meat. The maximum amount of fat which the average person eats is about 25 per cent of the weight of the cut. Recent experiments at the University of Illinois show that Choice or AA beef carcasses contain about 35 per cent of fat and 17 per cent of bone. Thus, when the packer sells a Choice 600-pound carcass to the retailer for 23 cents a pound, he delivers 60 pounds of surplus fat and 100 pounds of bone. The retailer

trims off some of the fat and sells it to be rendered for soap grease at 3½ cents a pound. He cuts off a little of the bone and sells it at three-fourths cent a pound. The housewife pays 30 or 40 or 50 cents for the remainder of the bone and excess fat. The bone goes to the dog or to the garbage can. If she is patriotic, she renders the fat (it yields 60 to 70 per cent of grease) and sells it back to her retailer at 4 cents a pound for soap grease. The fat in the packaging house is worth at least 7 cents and the bones 3 or 4 cents a pound.

It costs 85½ cents a hundred pounds to ship a car of dressed beef from Chicago to New York. In other words, it costs $5.13 freight for a 600-pound Choice carcass, $1.37 of which is for unwanted bones and waste fats. Furthermore, these bones and fat must be shipped elsewhere for utilization as inedible products. To me, it seems no more logical to ship the bones and surplus fat of the carcass to the retailer than it would be to ship him the hide and other inedible offal.

Our present system of shipping excess fat and bones about the country also results in a tremendous loss of much needed food. If the 60 pounds of surplus fat remained in the packing house, much of it would go into edible products, such as oleo margarine and shortening. Bones, if fresh, are a source of gelatin, beef extract and soup. Almost all this food value is lost when the surplus fat and bones go to the retailer and the consumer since most of them either end up in the garbage can or the rendering works.

Boneless, trimmed cuts have to sell at a higher price per pound than the same cuts untrimmed and bone in, altho the cost of the edible meat is no greater. Thus choice sirloin which sells around 45 cents a pound would have to sell at about 53 cents a pound, since only 80 per cent of sirloin is edible meat (lean plus 25 per cent of fat). The apparently higher prices would have to be explained to the customers. On the other hand, many of them think they save money by buying boneless cuts.

Neither is this an entirely new idea. Both Birdseye and Swift removed part of the bone from their frozen cuts. Since April, 1944, all the meat at Camp Shanks, New York, has been trimmed of excess fat, frozen, cut with power saws, wrapped and distributed to the cooks. This method reduced the number of butchers from 98 to 43. According to Col. Harry L. Calvin, executive officer: "By carefully saving every bit of fat and doing all the trimming in the central meat shop, we have rendered an average of 19,391 pounds of creamy

white odorless fats from 424,000 pounds of meat. The fat was used as shortening."

What effect would the distribution of frozen cuts have upon the consumer? Because of reduction in labor and transportation costs and spoilage, and greater competition among retailers, the consumer would pay less for the meat. Because of its increased tenderness and lower price, more meat would be eaten.

What would be the effect upon the producer? The packer can pay no more for livestock than he can get for the meat, plus a reasonable profit. Hence any economies in processing and distribution, especially when coupled with an increase in demand, is bound to result in higher prices to the stockman. Furthermore, since frozen meat will keep for a considerable time in the packer's, the retailer's or the housewife's freezer, the lower prices resulting from short seasonal gluts of livestock would be less disastrous to the producer.

Modern Trends with Dairy Herds

Condensed from The Jersey Bulletin

Dr. K. L. Turk
Cornell University

THE importance of well-fed and well-managed dairy cows to thousands of farm families is emphasized by the fact that, dollar for dollar, milk is the No. 1 cash crop of the American farmer. No individual dairyman can do much to influence the price he receives for his product, but he can boost his net profit by improved feeding and management practices. It is the spread, or margin, between costs of production and the price for which the product sells that determines the amount of money left over for the farmer. And the producing capacity of his cows does more to determine that profit for the dairyman than any other single factor under his control.

On a vast majority of dairy farms, dairy cows are kept as a means of converting unsalable products, such as pasture, hay, silage, and other roughages into milk—a product which is readily sold for cash. Nature geared the cow for the job of utilizing roughages.

In milk production, feed costs are generally found to be about equal to all other costs, including labor, depreciation, interest on investment, replacements, etc. It is obvious, therefore, that lowering feed cost is one of the most important factors to consider as we work toward greater efficiency of production in the future.

The problem of producing milk economically is more than just feeding the cows each day. It is a dairy farming proposition and is dependent upon (1) good cows of high productive capacity, (2) using the soil to the best advantage for growing feeds, (3) full utilization of low-cost feeds of high quality, especially pasture, hay and silage, and (4) efficient use of labor.

Records made by cows in dairy herd improvement associations in New York illustrate the relation between milk production per cow and income over feed cost. The cows were sorted into groups differing by 100 pounds of fat. Cows producing just over 150 pounds of fat returned $43 over feed costs while cows producing over 500 pounds of fat returned $245 over feed cost.

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There was an average increase in cost of grain of $10.50 for each increase of 100 pounds in fat production, but there was an average increase in income over feed cost of $50.50.

Using these records from another angle, it was calculated how much those cows of different productive capacities paid for the home-grown roughages they consumed. The low-producing group, averaging about 150 pounds of fat, paid only $11 for all of the pasture, hay and silage consumed while the cows producing over 500 pounds of fat paid $171 for the roughages. This amounts to 48 cents per ton in the first group and about $56 for the better cows. With each 100-pound increase in butter-fat production, there was an increase of $40 in the amount to pay for the roughages.

The dairyman should sell his home-grown crops to cows that will pay well for them. When he has a load of potatoes or a carload of hogs or steers to sell he watches market conditions in order to get the last price for his product, but how many farmers ask their cows how much they will pay for the feed they consume?

Successful and profitable "manufacturing" of milk, therefore, depends upon efficient "machines" and the use of low-cost materials. Milk-making nutrients are furnished most cheaply and satisfactorily by improved pasture grass, followed by high quality hay, silage and concentrate feeds. Consequently, good roughage fed to properly managed, high-producing cows is the key to economical milk production.

Dairy cattle have the ability to consume and utilize large amounts of roughage feeds because of the capacity of their digestive systems and because of the digestion of fiber which takes place in the four-fold stomach. Bacterial action in the rumen, or paunch, is beneficial in the digestion of fiber and cellulose. An important function of these bacteria is shown by the fact that the cow can make good use of non-protein nitrogen compounds, such as urea. The bacteria are able to use the urea in building up protein in their bodies and then the cow digests the bugs to get their protein. This is one of the best illustrations of co-operation we have in nature.

Hay is the most important single feed in the dairy ration, yet it varies more in palatability and feeding value than any other food. Feeding quality of hay depends largely upon its leafiness and green color. In addition, good hay is fine-stemmed, soft and pliable, sweet-smelling, free from weeds, trash and mold, and free from ripe seeds. Hay crops with these characteristics are essential

if a cow's capacity for roughage is to be fully utilized. Cows will consume more hay if it is good quality, and each pound consumed will furnish more digestible nutrients than will poor quality hay.

With high quality hay and an improved pasture program, the amount of grain needed to hold milk production up at a high level can be greatly reduced. This is illustrated by the results of two New York herds. Both of them were high-producing herds, averaging just under 500 pounds of fat per cow. One had ordinary pasture and hay and it was necessary to feed over 5,800 pounds of grain per cow during the year. This amounted to 38.9 pounds of grain for each 100 pounds of milk produced. On the other hand, the second dairyman had improved pasture and high quality hay and fed only 2,143 pounds of grain to each cow during the year. This amounted to 15.4 pounds of grain for each 100 pounds of milk produced.

Weather is one of the most important factors affecting hay quality, yet the farmer himself has a great deal to do with it through earlier cutting and use of proper methods in curing. Modern developments in machinery and greater labor efficiency will help to increase the speed of handling hay and will improve the quality. Use of barn driers, hay crushers to crush the stems and speed up drying, and field balers are aiding considerably in the improvement of quality in hay.

High producing cows have a high energy requirement, and it is necessary that a large portion of the ration consist of concentrates, or grain feeds. An intelligent use of concentrates enables the dairyman to make up mixtures that will properly supplement the available roughage and meet the individual requirements of cows.

It is very difficult, however, to make up for deficiencies in poor quality hay through the grain mixture. We may have many unknown milk stimulating factors in grass. And good hay will "cover up" many apparent deficiencies in grain. The fortunate dairymen who have high quality hay do not have to worry very much about the formula of their grain mixture. Almost any combination of feeds that furnish plenty of digestible nutrients and are palatable will do the job.

The amount of protein needed in the concentrate mixture is dependent upon the kind of roughage fed. Many experiments have been conducted on this point and have been especially important during the war years when high protein feeds have been scarce and difficult to obtain. A long series of investigations at Cornell conducted by the late Professor

Savage has been particularly useful. Cows produced just as well on a concentrate mixture that furnished 16 per cent total protein as they did on 20 or 24 per cent protein mixtures. They were fed with mixed hay, containing 30 to 50 per cent legumes, and corn silage. These results showed that the high levels of protein commonly fed by New York and northeastern dairymen are unnecessary.

In spite of many common beliefs to the contrary, all experimental evidence shows that simple concentrate mixtures will give just as good results as more complex ones. At Cornell, a simple mixture composed largely of ground whole grains was equal to the test-cows mixture when fed with mixed hay and corn silage. Another ration composed largely of by-product feeds was equal to one using both grain and by-product feeds. Other mixtures containing 25 or 50 per cent corn gluten feed were as efficient as more common mixtures.

Five years of experiments at Cornell gave no differences between high quality protein and low quality protein mixtures. The so-called poor quality mixture was composed of ground corn, ground oats, corn gluten feed, and corn gluten meal. The high quality mixture contained corn, oats, corn gluten feed, corn distillers' dried grains, soybean oil meal, linseed meal, and cottonseed meal. Both mixtures were fed with mixed hay.

Little has been said in this discussion of the mineral and vitamin needs of dairy cattle, yet they are the things that are being publicized the most. More cattle suffer in this country from a lack of total feed, or energy, than suffer from a deficiency of any mineral or vitamin. If an animal is fed properly and liberally of natural feeds, deficiencies of minerals and vitamins will occur only in certain areas and in rare circumstances. We should not try to make up for a lack of feed by feeding tonics and unusual compounds.

Much interest is now being centered in cobalt in New England. The evidence that a deficiency occurs in some areas appears to be clear cut, but we need more data before recommending that this element be added to all dairy rations.

In the vitamin field, vitamin A is the most important one to consider in practical feeding because it is the one most likely to be lacking. This again focuses attention on improved pastures, quality hay and silage production, and, in most cases, the vitamin can be supplied from these natural feeds.

Shepherd Sunday on Switzerland's Belalp

Condensed from The National Wool Grower

Karl Egli

YEARLY on the second Sunday in September the peasants in the region of Belalp above Brigue, in the Swiss Valais, celebrate Shepherd Sunday. This day has been set aside for the return of the sheep from the summer pastures, and many a farmer's hopes for the winter are pinned on the size and condition of his returning flock.

At the beginning of May the sheep of the nearby villages of Naters and Blatten are driven through Belalp to the lonely pastures higher up. There, throughout the summer, they are left alone and only every three or four weeks a herdsman climbs up to the grazing grounds to feed the animals some salt and to check up on their general condition. If a sheep has had an accident the man will detach its earmark and submit the proof of its death to the owner.

On the second Sunday in September all the sheep owners gather at sunrise on the glorious Alpine plateau of Belalp. Preceding them four or five shepherds are already on their way to the perilously located pastures where the sheep have spent the summer months. The waiting peasants first offer their prayers for the safe return of their flocks during an open-air Mass. Afterwards the long hours of waiting are spent in friendly companionship.

After the shepherds have reached the herds and assembled them by means of curious guttural calls, the tedious descent for Belalp is started. Adventuresome animals have to be kept off from browsing the juicy herbs that often grow on the very brink of the precipice, and tiny lambs, lagging behind from sheer fatigue, must be carried occasionally.

At last the peasants waiting at Belalp perceive the long line of sheep cautiously stepping down the mountain side. A rush is made to catch a first glimpse of them as they approach the village and are driven to a spacious corral for the night. By about 7 p.m. herds, numbering from 800 to 1000 heads, are together, ready for a preliminary inspection by their owners. A merry "Sheep Dinner" follows this function.

Early on Monday begins the task of sorting the animals. From the general corral the identified

sheep are then led to the smaller "owners' enclosures." A pasture-fee of twenty-five centimes per sheep has to be paid at that time by the farmers.

Washing the sheep is next on the program. Each peasant drives his flock of 20 to 50 animals to the Alpsee. The sturdiest member of the herd is now driven or thrown into the lake and, as soon as their leader begins to swim toward the opposite bank, the rest of the flock follows. This cleansing process is necessarily accompanied by plenty of noise, but as soon as the animals have crossed the lakes, the brilliant sunshine and mountain breeze accomplish a thorough drying within a few hours.

Then, one by one, the herds and their owners leave for their homes, where the all-important work of shearing is immediately begun.

Salt is a "Must" for Stock Feeding

SALT is a "must" for stock feeding and with the diversion of a good percentage of our feed to hungry Europe, saving of feed becomes a "must" to the farmer. There was a sensation at Purdue's most recent Swine Day at the end of an 85-day experiment when they showed that a penny's worth of salt saved better than $6.00 worth of feed per pig and made each pig that had free access to salt worth $12.00 more than his brother who didn't. This kind of economy cannot be overlooked.

Farmers' Bulletin No. 1549, issued by the United States Department of Agriculture, says that salt should be kept before cattle at all times; and in Farmers' Bulletin No. 1626, published a little later, they write that all animals need common salt and that the "dairy cow's minimum requirement is 0.75 ounce for each 1,000 pounds of live weight, and 0.3 ounce additional for each 10 pounds of milk yielded." This is a daily minimum. If, according to the bulletin, cows are properly fed on good-quality feeds that are produced on soils with no pronounced mineral deficiencies, ordinarily no addition of any mineral other than common salt to their ration would be required. It is to be noted here that the Department implies that salt must be fed daily in addition to any feed that is used. This same information applies either to the feeding of dairy or beef cattle or other farm animals. The Wisconsin Agricultural Experiment Station has proved, after exhaustive tests, that if livestock is deprived of all salt, gradually the animals will lose vitality, grow thin, and finally break down completely. A trial at the Mississippi Agricultural Experimental Station with three cows showed a gain of 110 pounds of milk in two weeks in favor of cows having free access to salt.

Pigs need salt just as the dairy cows or beef cattle do, and the result of an experiment by the Director of Animal Husbandry of the Iowa State Agricultural College proved how erroneous the idea is that pigs should not have salt. This experiment shows that nothing could be further from the truth. At that college two equal numbers of pigs were separated. Salt was taken away from one lot. The pigs not receiving any salt took 218 days to reach 300 pounds in weight; whereas, the pigs permitted free access to salt, but otherwise fed in exactly the same manner, took

only 158 days to reach 300 pounds.

Salt is just as necessary to the health and growth of sheep. Sheep should, however, be fed loose salt and not blocks. One of their peculiarities is that they wear their teeth down gnawing on block salt. Block salt should be in all other pastures. For convenience, as well as for economy, loose salt, if fed that way, can more readily be used under cover where it is not likely to be trampled on. Block salt usually is made in 50-pound blocks, having an indentation made sufficiently deep to enable one to put it on a stake driven into the ground. This makes it easier to get at, keeps it cleaner, and it will dissolve less readily from rain.

Salt blocks can be had of plain salt or can be had containing phosphorus, sulphur, or iodine. Many of our soils have been depleted of their phosphorus, and crops grown on them have such low contents of phosphorus as to lead to malnutrition of animals consuming them. Any edible compound of phosphorus is effective in correcting a phosphorus deficiency, according to Bulletin No. 1626. The percentages of minerals added to salt blocks usually compensate for lack of those minerals so frequently found in some soils.

Farm animals given free access to salt seldom, if ever, overeat. They will ordinarily not consume too much salt unless they have been deprived of it over a long period. If that is the case, it is considered wise to start feeding it in small amounts, gradually increasing the daily quantity until the extra craving is satisfied. Then free access to salt should be permitted the stock at all times.

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

A Living from Bees—By Frank C. Pellett, Field Editor of American Bee Journal. Orange Judd Publishing Co., Inc. $2.25.

America's Garden Book—By Louise Bush-Brown and James Bush-Brown. Charles Scribner's Sons. $3.50.

An Agricultural Testament—By Sir Albert Howard, C.I.E., M.A., former Director, Institute of Plant Industry, Indore. Oxford Univ. Press. $3.50.

Animal Sanitation and Disease Control—By Dr. R. R. Dykstra, Dean, School of Veterinary Medicine, Kansas State College. The Interstate Printers and Publishers. $2.85.

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A. & M. College of Texas, College Station, Texas. The Interstate Printers & Publishers. $2.00.

Breeds of Livestock in America—By Henry W. Vaughan, formerly Prof. of Animal Husbandry, Iowa State College. College Book Co. $3.75.

Dairy Cattle Feeding and Management—3rd Edition—By H. O. Henderson, Prof. of Dairy Husbandry, W. Va. Univ., Carl W. Larson and Fred S. Putney. John Wiley & Sons, Inc. $4.00.

Dairy Science—By W. E. Petersen, Ph.D., Assoc. Prof. Dairy Husbandry, Univ. of Minn. By R. W. Gregory. J. B. Lippincott Co. $4.00.

Diseases and Parasites of Poultry — By Edgar Hugh Barger, D. V. M., Berkeley, Calif., and L. E. Card, Ph.D., Prof. of Poultry Husbandry, Univ. of Illinois. Lea & Febiger. 3rd Edition. $3.75.

Farmers of the World—The Development of Agri. Extension—edited by Edmund deS. Brunner, I. T. Sanders, Douglas Ensminger. Columbia Univ. Press (1945). $2.50.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. $3.00.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.

Farm Management—By Robert R. Hudelson. The Macmillan Co. $2.50.

Farm Management and Marketing—By V. B. Hart, M. C. Bond, L. C. Cunningham, all of N. Y. State College of Agriculture, Cornell University. John Wiley & Sons, Inc. $2.75.

Grow Your Own Fruit—By M. G. Kains, formerly U. S. Dept. of Agri.; Prof. of Horticulture, Penna. State College. Greenberg, Publisher. $3.50.

Growing Tree and Small Fruits—By H. B. Knapp, Director, State Institute of Applied Agri., Farmingdale, L. I., N. Y., and E. C. Auchter, Chief, Bureau Plant Industry, U. S. D. A. John Wiley & Sons. $2.75.

How to Raise Rabbits for Food and Fur—By Frank G. Ashbrook, Fish and Wildlife Service, U. S. Dept. of the Interior. Orange Judd Publishing Co., Inc. $2.00.

Judging Dairy Cattle—By Edwin S. Harrison, Professor of Animal Husbandry, Cornell University. John Wiley and Sons, Inc. $2.75.

Livestock Production—By Walter H. Peters, Chief, Div. of Animal and Poultry Husbandry, Univ. of Minn. McGraw-Hill Book Co., Inc. $4.00.

Livestock Judging Handbook — By Julius E. Norby and W. Malcolm Beeson, Ph.D., Asst. Professors Animal Husb., Univ. Idaho. The interstate Printers. $2.60.

Modern Agricultural Mathematics—By Maurice Nadler, B. S., A. M., Dept. of Mathematics, Newtown High School, Long Island. Orange Judd Publishing Co., Inc. $2.00.

Modern Farmers' Cyclopedia of Agriculture—By Earley Vernon Wilcox, Ph.D., formerly U. S. Dept. of Agri. Orange Judd Pub. Co., Inc. $4.50.

Natural Principles of Land Use—By Edw. H. Graham, Chief of Biology Div., Soil Conservation Service. Oxford University Press. $3.50.

Palestine—Land of Promise — By Walter Clay Loudermilk, assistant chief of the Soil Conservation Service. Harper & Brothers. $2.50

Pay Dirt—Farming and Gardening with Composts — By J. I. Rodale. Devin-Adair Co. (1945). $3.00.

Pleasant Valley — By Louis Bromfield, author, farmer, soil conservationist. Harper and Brothers. $3.00.

Pork Production — By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. The Macmillan Co. $3.75.

Poultry—By A. R. Winter, Asst. Prof. Poultry Husbandry, Ohio State Univ., and E. M. Funk, Asst. Prof. Poultry Husbandry. Mo. State Univ. J. B. Lippincott Co. $5.00.

Practical Farming for the South — By Benjamin F. Bullock, now Prof. Rural Education, Atlanta Univ. Univ. of North Carolina Press. $2.50.

Profitable Poultry Keeping—By H. Clyde Knandel, Head, Dept. Poultry Husb., Penn State College. Orange Judd Publishing Co., Inc. $3.00.

Repairing Farm Machinery—By Ivan G. Morrison, Asst. Professor Agri. Education, Purdue Univ. The Interstate Printers & Publishers. $1.80.

Seaman A. Knapp—Schoolmaster of American Agriculture—By Joseph C. Bailey, Dept. History and Social Science, Hunter College. Columbia University Press. 1945. $3.25.

The American Land — Its History and Its Uses — By William R. Van Dersal, biologist in the U. S. D. A. Oxford University Press. $3.75.

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Book Co., Inc. $4.50.

Soil Conservation—By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Dept. of Agric. McGraw-Hill Book Co., Inc. $6.50.

Successful Poultry Management—By Morley A. Jull, Professor and Head of Poultry Dept., Univ. of Maryland. McGraw-Hill Book Co., Inc. $3.50.

The Farm Primer—By Walter Magnes Teller, formerly with the Farm Security Administration, U. S. D. A. David McKay Co. $2.50.

Weeds of Lawn and Garden — By John M. Fogg, Jr., Prof. of Botany, Univ. of Penna. University of Pennsylvania Press (1945). $2.50.

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